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7th Asian Fisheries Forum 04

THE TRIENNIAL MEETING OF THE ASIAN FISHERIES SOCIETY

30 November - 4 December 2004 PENANG , MALAYSIA

PROGRAMME

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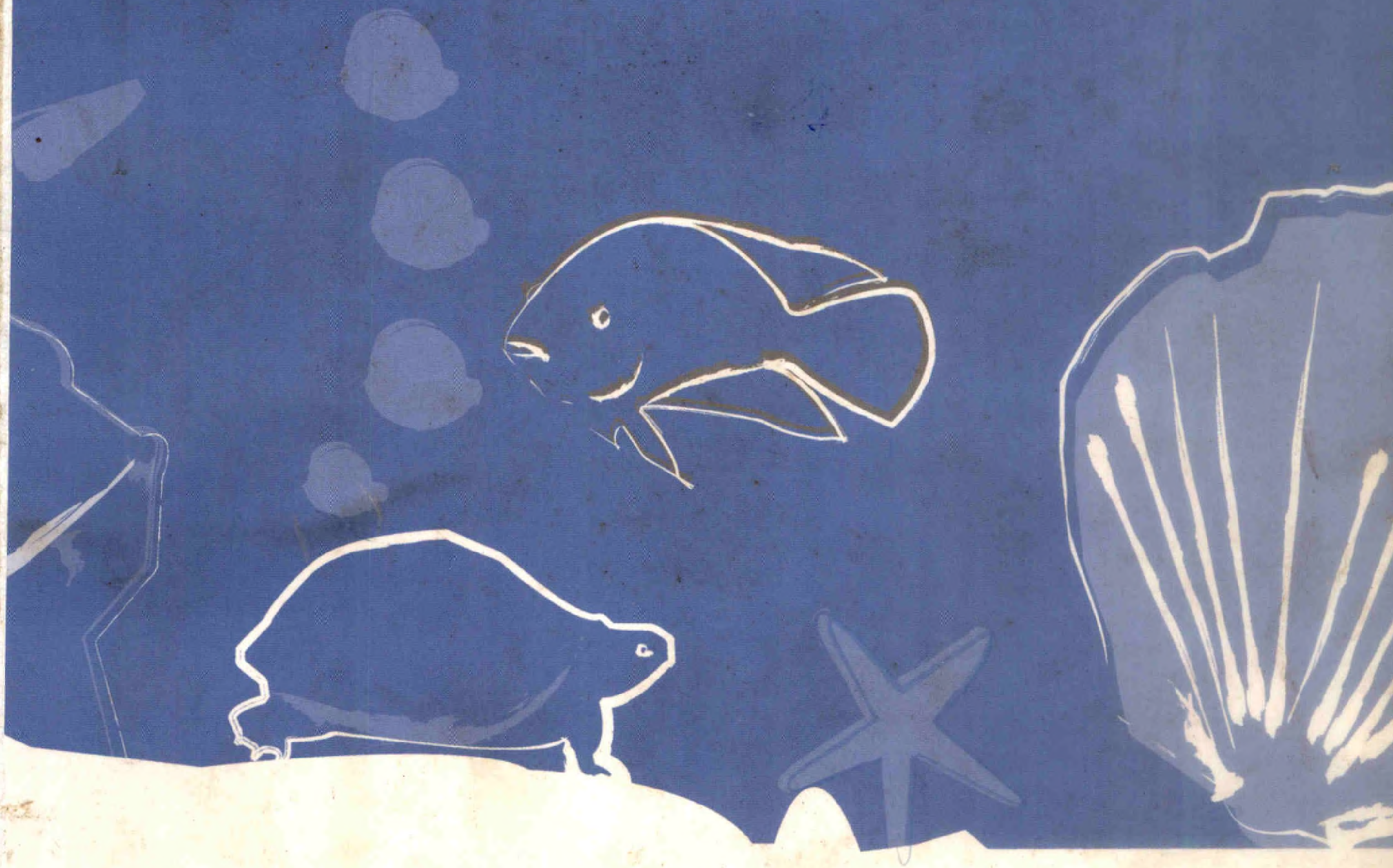

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Universiti Sains Malaysia
Universiti Putra Malaysia
Ministry of Agriculture and Agro - Based Industry Malaysia
Department of Fisheries Malaysia
Fisheries Development Authority of Malaysia
WorldFish CENTER
INFOFISH
Malaysian Fisheries Society

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Organised by

Asian Fisheries Society
Universiti Sains Malaysia
Universiti Putra Malaysia
Ministry of Agriculture and Agro-Based Industry, Malaysia
Department of Fisheries, Malaysia
Fisheries Development Authority of Malaysia
WorldFish Center
Infofish
Malaysian Fisheries Society

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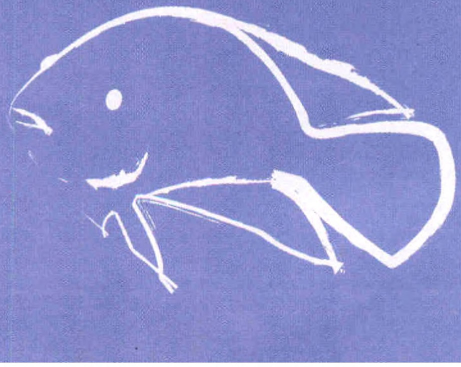

Message from The Right Honourable Datuk Seri Abdullah Ahmad Badawi

The hosting of the 7th Asian Fisheries Forum for the first time in Malaysia is timely and is in line with the Government's strategy to invigorate the agriculture sector as one of the engines of growth. Agro-based industries, together with advancement in biotechnology, can translate the country's rich natural resources into a rewarding and productive sector of our economy that generates new and additional wealth for the people.

The Government has taken several measures to promote the agriculture sector. Among others, greater importance has been attached to research and development (R&D) and more emphasis has been placed on the adoption of modern agriculture methods through better use of technology. In ensuring the success of these measures, the Government welcomes the active participation of the private sector, including universities, to be the catalyst in this process.

In this light, I am pleased to note that this Asian Fisheries Forum series has facilitated the sharing of knowledge and advances in the fisheries and aquaculture sciences throughout the Asian region. It is my hope that the forum will discuss new ideas and innovations, which would be beneficial to all. I hope that the fruits of this gathering will enhance the efficiency, productivity and safety of our respective fisheries industries. I wish all of you a most rewarding and memorable forum.

Thank you.

Datuk Seri Abdullah Ahmad Badawi
Prime Minister of Malaysia

Message from
The Honourable Tan Sri Muhyiddin Mohamed Yassin

On behalf of the Ministry of Agriculture and Agro-based Industry, I am honoured to welcome all participants, including the many distinguished foreign guests to Penang, Malaysia.

The fisheries sector in Malaysia produced RM 5.41 billion worth of business in 2002 consisting of about 1.5 million tonnes of seafood and 408 million pieces of ornamental fish. It contributed about 1.50% to the GDP and provided direct employment to about 83,000 fishers and 17,000 aquaculturists. Marine capture fisheries contributed 87% of Malaysia's seafood production with the rest coming from the aquaculture sector.

The fisheries sector has been earmarked by the Malaysian Government under the Third National Agricultural Policy (1998-2010) for rapid development. The NAP3 emphasises development towards a fully modern and commercialised capture fisheries and aquaculture industry through exploitation of available resources on a sustainable basis. Working together with the Malaysian Fisheries Department, non-governmental organisations involved in fisheries and various research institutions, my ministry believe that we can increase the sector's contribution to our economy as well as attaining national food security.

Under the NAP3, the seafood production from the aquaculture sector has been targeted to increase production from 191,000 tonnes in 2002 to more than 600,000 tonnes by 2010. Various initiatives, government policies, loans and tax incentives are currently put in place by my ministry to ensure we reach this target in the next few years. The aquaculture sector in Malaysia is indeed experiencing a new lease of life.

We greatly encourage all efforts in this common goal to further develop the fisheries sector in the Asian region and gladly share in pushing for initiatives in this direction.

May you have a productive Forum experience here in Penang. Selamat Datang !

Thank you

Tan Sri Muhyiddin Mohamed Yassin
Minister of Agriculture and Agro-based Industry

Universiti Sains Malaysia

Message from
The Honourable Professor Dato' Dzulkifli Abdul Razak

It gives me great pleasure to extend my sincere and warm welcome to the participants of the 7th Asian Fisheries Forum 2004. On behalf of the University, let me welcome all of you to the forum on this beautiful island of Penang.

USM is honoured to play host for the very first time to esteemed scholars and practitioners in Fisheries in Malaysia. As the Vice Chancellor of Universiti Sains Malaysia, I would like to thank the co-organisers of the forum, all key institutions in fisheries and aquaculture in Malaysia, for their unequivocal support and cooperation towards the success of this very timely initiative.

Fishing and aquaculture are central activities that contribute to the livelihood and food security of a nation; in some cases it forms the primary source of protein. Alongside the increasing popularity of fish and fish products, particularly for health reasons, it is inevitable that a concomitant increase in fisheries production is essential. To meet these spiraling demands, we have not only witnessed the rapid expansion of aquaculture but the subsequent increase in fishing activities, which has led to over-fishing. This has not only threatened marine life but has also led to a marine conservation crisis. This is the backdrop to this Forum.

As governments in the Asian region introduce new initiatives and development policies to rejuvenate and protect the fisheries and aquaculture industries as well as the environment, it is imperative that universities and research institutions play a fundamental role in ensuring that the objectives of these policies are realised. Such institutions can complement government proposals by embarking on research that is relevant and valuable to the needs of respective nations, identifying aquaculture 'hotspots' and pursuing extensive research so that the outcome and technology generated can be transferred effectively to the end users.

Development in fisheries can only be sustained to the extent that it is human centered. It must be geared to meet the needs of peoples and this can only be successfully achieved by ensuring their full and unhindered participation. This in turn calls for a plan of action to remedy the imbalance between the knowledge and skills needed and the ability to execute and translate these into testable and workable practical realities in fisheries.

This forum is timely; not only has it succeeded in bringing together eminent fisheries and aquaculture researchers worldwide but it has also brought together researchers, policy makers and members of the private sector. This global concerted effort by all the stakeholders of the industry to improve and manage our world resources should be lauded. I strongly believe that this Forum is an extraordinary testimony to our capacity building at regional and local levels. I believe USM has something interesting to share with all of you in this area.

I hope that new friendships and fruitful collaborations will be forged.

Professor Dato' Dzulkifli Abdul Razak
Vice Chancellor, Universiti Sains Malaysia

Message from
Dr. Clarissa L. Marte

The Asian Fisheries Society continues the tradition of holding its triennial forum to gather fisheries scientists, students, and other stakeholders to share experiences, present current technical advances, and discuss problems and issues in fisheries and aquaculture unique to the Asian region. Since its founding in 1984, AFS has successfully held forums in Manila (1986), Tokyo (1989), Singapore (1992), Beijing (1995), Chiang Mai (1998), and Kaoshiung (2001). Asia is the world's largest producer of fish and aquatic products and will continue to be the leader in this area of food production with the active involvement of all sectors engaged in fisheries and aquaculture. The faced paced developments and adoption of new technologies in fisheries and aquaculture however have brought many problems to fishfarmers and governments. The theme, "New Dimensions and Challenges in Asian Fisheries in the 21st century" highlights these issues and problems that are presently faced by Asian fisheries and will address prospects, challenges, and issues in fisheries and aquaculture that will confront the region in response to global development.

In behalf of the Asian Fisheries Society, I wish to thank the Universiti Sains Malaysia for hosting the 7th Asian Fisheries Forum and the following co-organizers for their support: Ministry of Agriculture, (Malaysia), Department of Fisheries (Malaysia), Fisheries Development Authority (Malaysia), Malaysian Fisheries Society, WorldFish Center, INFOFISH, and the University Putra Malaysia. The success of this forum rests on the untiring efforts of the members of the organizing and various committees and the support of society members who have come to participate and share their knowledge and experiences. To all, my sincere gratitude and appreciation.

Clarissa L. Marte

Clarissa L. Marte
President, Asian Fisheries Society

Message from
Professor Roshada Hashim

On behalf of the Steering and Local Organising Committees, it is indeed a great honour to bid a warm welcome to all delegates from almost forty countries, to Malaysia and to Penang. The 7th Asian Fisheries Forum 2004 is a culmination of three years of planning and cooperation between all the relevant fisheries related institutions in Malaysia.

This meeting of over 600 participants worldwide is indeed timely and crucial in a setting where there is an incremental shift in global fisheries production from both capture fisheries and aquaculture towards many Asian countries besides China. With this expansion comes a host of emerging issues and challenges which necessitates innovative approaches hence the theme of our meeting "New Dimensions and Challenges in Asian Fisheries in the 21st Century." However, as we deliberate on strategies to meet these challenges, in tradition with previous fora, we have remained mindful of other pertinent and inherent issues unique to the region; issues of gender involvement, fisheries role in poverty eradication and food security are also given due emphasis.

When you read the programme you will notice a thematically rich line up of 9 technical sessions and 11 special symposia. There are over 500 oral and poster presentations painstakingly prepared by the participants. The mix of theoretical and practical approaches, should make this forum a very worthwhile, educative and valuable experience. I trust that it will be a critically transformative gathering.

There is an impressive amount of expertise in this assembly in the areas of fisheries and aquaculture with experience from researchers, practitioners and pioneers in different countries. It is my sincere hope that you will grasp and appreciate this unique opportunity to share your experiences and further develop your understanding, your involvement and networking in this field.

Penang is known as the Pearl of the Orient, with a remarkable history, rich culture, modern shopping centres and beautiful promenades. I hope you will spend some time during your stay here to discover the wonders of this island and return home not only with valuable information gained during the forum but with new friends and fond memories.

Finally, I would like to thank the co-organisers of this forum for their absolute support and to the Local Organising Committee for their dedication and display of team spirit especially during the challenging moments. Last but definitely not least, a very special mention to the graduate students of the School of Biological Sciences, USM, for their boundless energy, enthusiasm and sustained momentum, in assuring that this gathering is a success.

Professor Roshada Hashim
Chairperson, Organising Committee

Organising

Patron

Hon. Tan Sri Muhyiddin Mohamed Yassin

Advisor

Hon. Prof. Dato' Dzulkifli Abdul Razak

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7th

Opening Ceremony Programme

Asian Fisheries Forum

8.30am	Arrival of participants
8.45am	Arrival of invited guests
9.20am	Welcome speech by the Chairperson
9.25am	Introduction speech by the Vice Chancellor, USM
9.30am	Opening Speech by the Minister of Agriculture and Agro - Based Industry Malaysia
9.40am	Official Opening of the 7th Asian Fisheries Forum
10.00am	Tea break

Trade Exhibition (invitation only)

10.00am	Opening of Trade Exhibition
11.00am	Tea break
11.15am	Press conference

Keynote speakers

Dr. Meryl J. Williams, Executive Officer, Future Harvest Alliance Office.

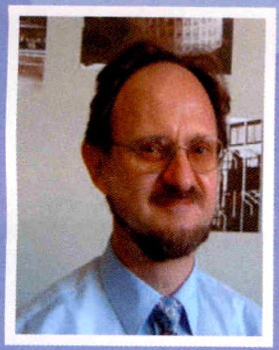
" How to Make a Difference: Fisheries Research for Impact in Asia "

Dr. Williams is the inaugural Executive Officer of the Future Harvest Alliance Office formed this year by 15 international agricultural research centers of CGIAR. She was formerly the Director General of the WorldFish Center (1994-2004). Before joining WorldFish Center, she was the Director of the Australian Institute of Marine Science. She also served as Executive Director of the former Bureau of Rural Resources in the Department of Primary Industries and Energy (Australia). In recognition of her contributions to fisheries and marine science, she has received numerous honors including Fellow of the Australian Academy of Technological Sciences and Engineering, Australian Centenary Medal, FAO Advisory Committee on Fisheries Research, steering committee of the Census of Marine Life, DIVERSITAS, Millennium Ecosystem Assessment, among others.

Dr. Mahfuzuddin Ahmed, WorldFish Center.

“ Globalisation and its Impact on Asian Fisheries: Implications for Management ”

Dr. Mahfuzuddin Ahmed is the Principal Social Scientist and Program Leader of the Policy Research and Impact Assessment Program of WorldFish Center which contribute to shaping fisheries policies in developing countries. He is the current President-elect of the International Institute for Fisheries Economics and Trade, and has recently co-authored a book on the future of fish entitled “Fish to 2020 - Supply and Demand in Changing Markets”. A number of his past research work are regarded as pioneering research on the knowledge and understanding of regional and national issues in fisheries. Due to his wide knowledge and experience in Asian fisheries, he is often called upon to perform advisory roles in various international organizations which includes the International Foundation for Science, Mekong River Commission, DANIDA and the Asian Development Bank.



Mr. Rolf Willman, Food and Agriculture Organization, Rome, Italy.

“ Restoration and Management of Small Scale Fisheries: Meeting the Challenge "

Mr. Willman is the Senior Fishery Planning Officer with the Fisheries Department at FAO, Italy. He started to take interest in the roles of small-scale fisheries while posted to the FAO Bay of Bengal Programme in Chennai, India, where he conducted a detailed costs and earnings study of traditional and mechanized marine fisheries in India. He maintains close contacts with the International Collective in Support of Fishworkers (ICSF) and his areas of interest include the analysis of economic and social implications of the transition to responsible fisheries, fisheries management policies, integrated environmental and economic accounting, sustainability indicators and eco-labeling. His current responsibility at FAO includes the development of guidelines on increasing the contribution of small-scale fisheries to poverty eradication and food security.

Prof. Hew Choy-Leong, Department of Biological Sciences, NUS, Singapore.

" Functional Genomics Study of Marine Viral Pathogens "

Prof. Hew is currently the Head of the Department of Biological Sciences at the National University of Singapore. He has received numerous accolades in his illustrious academic career including honorary professorships and merit awards from several universities in China and Canada. His research interests include biotechnology of fish antifreeze proteins, transgenic fish, molecular endocrinology, proteomics, cancer biology and functional genomic studies of marine viral pathogens. He has published more than 190 refereed papers in many prestigious international journals including in the journal Nature. He is also the Program Leader for the Structural Biology Programme at NUS where he continues to promote the importance and potential of biotechnology as a tool to improve the productivity of aquaculture and fisheries.

How to Make a Difference

Fisheries Research for Impact in Asia

Meryl J Williams[1]

Abstract

Fisheries science is an applied science that is directed to support the sustainable management of natural fisheries resources. Yet, many fisheries in Asia are seriously depleted. Has fisheries science therefore failed in its main function? In this paper I argue that, in Asia, it cannot be blamed for the state of fisheries because fisheries development outpaced the growth of knowledge on how to sustain fisheries, among other reasons. However, if fisheries science is to help the region's fisheries become sustainable, then it needs to change itself. It needs to develop new, targeted research agendas that address the problems, build its research and development institutions and their capacity to carry out the research agenda and commit to collecting, publishing and making accessible the supporting data and information. We will all need to heed these changes, whether we are students, new scientists starting our careers, experienced research managers or staff of investor agencies.

The State of Fisheries Resources and the Role of Fisheries Research

Today, fisheries are in the limelight. Wherever you live, the media want to write about what is happening to fisheries. 'Catches, collapses, and controversies' is a typical sub-heading where fisheries are talked about (Gewin 2004), or this from the Food and Agriculture Organization (FAO 2004a) – 'Overfishing on the Increase in Asia Pacific Seas.' For fisheries scientists, this attention is a mixed blessing. On the one hand, it gives new prominence to our field of endeavor and means that it is easier to get public attention. On the other hand, it puts many scientists in the 'hot seat' in their organizations and countries. Who wants to be the one to tell the Director General of fisheries or the Minister or the President that the fish stocks are in bad shape and something needs to be done about it? Few of us relish this part of the job of being a fisheries scientist.

Now a typical job description for a fisheries scientist contains terms of reference such as: 'undertake research and provide scientific advice to the Department of Fisheries for the sustainable management and development of coastal fisheries.' When you visit your mother and she asks you over lunch how your job is going – what do you say? Do you tell her about the fascinating new sea creature you caught on your last trip to sea? Do you tell her that the fish surveys that you are in charge of are showing that fish are becoming smaller and scarcer and warn her that she is likely to be paying more for her favourite kembong or galunggong[2] in the years to come? What do you tell her when she then asks what good has your work actually done?

This is at the heart of the topic I wish to address today. How can we, as fisheries scientists, have the sort of impact that will enable us to confidently tell our mothers (or sons or grandchildren) that we have helped to make the fisheries of Asia better? This presentation is addressed to fisheries scientists of Asia– the researchers, technicians, data managers, research managers, research institute leaders and the research investors from the science ministries and development assistance agencies whose business is research, development, monitoring, information management for the natural fisheries resources in Asian seas and inland waters.

The state of fisheries in Asia and the Pacific, and indeed around the world, is cause for deep concern, even as their importance to the region is recognized. FAO (FAO 2004b) confirmed recently that Asia-Pacific is the largest fish producing region, in both aquaculture and capture fisheries. Aquaculture and fisheries in Asia Pacific accounts for 91 and 48 percent of total world production, respectively. In 2002, 46.9 million tonnes were produced from aquaculture and 44.7 million tonnes from capture fisheries. I wish to concentrate on the fisheries science that is directed to making the fisheries catch sustainable and will leave the aquaculture research component to others to address. You will note, however, that already aquaculture is outstripping fish production in Asia Pacific.

Most natural fish stocks in the region cannot sustain even their current productivity in the face of heavy fishing pressure and declining environment quality. A study of the state of coastal fish stocks in 8 Asian countries[3] by the scientists of those countries and WorldFish Center (Silvestre et al 2003a) showed that 'alarmingly, stocks are down to 5-30% of the original unfished levels...in most countries.' The study also showed that the more valuable fish species were severely depleted and smaller, less valuable species had increased, thus indicating that major stock rehabilitation was required to restore the economic potential of the fisheries.

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[1] Executive Officer, Future Harvest Alliance Office, and Chair, Board of Management, Australian Center for International Agricultural Research, m.j.williams@cgiar.org

[2] Common names in Malaysia and Philippines, respectively, for Rastrelliger kanagurta, see http://www.fishbase.org

[3] Bangladesh, India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand and Vietnam

the same time, Asian demand for fish is rising, driven by growing populations, greater affluence and the promotion of the nutritional benefits of fish. Delgardo et al (2003) modeled the rising demand for fish to 2020, using mainly population and income parameters. They showed that the growth in domestic Asian markets out to 2020 would not be matched by growth in supply. This would mean that less fish would be exported from Southeast Asia countries and Bangladesh, although China and India would continue to increase their exports of fish. Currently, fish are heavily traded in Asia, with the region having a trade surplus that benefits the national economies, while maintaining high per capita consumption of fish by world standards.

Fish trade is already the subject of trade wars for Asia. Catfish, shrimp, tuna and even seaweed trade doors are only kept open with a good deal of effort by the countries of the region. And fish trade often gets bad press for taking fish out of the mouths of local people. Kurien (in press) found that international trade brings economic benefits to many developing countries, creating large numbers of jobs, especially for women in processing, and helps improve the standard of fish products. Kurien's study teams found no evidence that fish exports lessened the amount of fish available for food locally but they did conclude that 'the shark's share of the benefits from international fish trade accrue somewhere between the rich-country consumer and the poor-country producer.' They also found evidence that trade has moved some control from local fishers and tends to push them to the limits of their personal safety. Further, the employment created through trade has little job security, offers few worker benefits and is insecure if trade shifts.

29.5 million people are directly employed in the fisheries and aquaculture sectors in Asia (75% in fishing and 25% in aquaculture) but the sector supports several times this figure through their households and the ancillary support sectors. This direct employment represents 85% of world employment in fisheries and aquaculture (Table 1)

Table 1: Growth in Number of Asian Fishers (derived from FAO 2003)

	1970	1980	1990	1995	2000
Asia: fishers and fish farmers	9,301	13,690	23,656	28,552	29,509
World: fishers and fish farmers	12,285	17,036	27,837	33,314	34,536
Asia: fish farmers	na	na	3,698	6,003	7,132
World fish farmers	na	Na	3,778	6,254	7,470

Given the production totals for Asia, the average productivity per fisher for capture fisheries is low in Asia as 82% of the world's fishers catch only 48% of the world fish. For aquaculture the productivity per fisher is closer – Asia has 95% of the world's fish farmers producing 91% of world aquaculture production.

Many involved in the fish sector in Asia and elsewhere in the world are poor and work under conditions that are recognized by the ILO as the most dangerous of all occupations. Fatality rates for fishers are higher than those for police and fire fighters and few fishers are covered by any international safety regulations (ILO 2004). HIV/AIDS rates are also higher among fishers than among those in many other occupations (Huang 2002, Allison and Seeley 2004) and the risks of spread increased by the lack of access to mainstream health and medical services.

To top off the problems facing natural fisheries, they are beset with all the challenges of economic development, especially in the coastal zone and along rivers, and the threats of climate and climate change. As the East Asia Seas congress noted last year (EAS 2003):

> *Today, the fishing villages, beaches, coral reefs, mangroves, wet markets and seafood stalls are being replaced by ports, shopping malls, manufacturing industry, high rise apartments, tourist resorts, fish ponds and cages, and too often the waters are being fouled by the human sewage and industrial waste of coastal populations that are growing faster than those in the hinterland. All of these developments are taking their toll on the fisheries.*

These snapshots of the current fisheries situation in Asia are designed to give a quick picture of the place of fisheries in the life of the region – providing jobs, food and foreign exchange, recreation and natural heritage - and their complexities – low productivity, trade, labor and health challenges. We see threatened resources, many necessary but poorly paid jobs and a need for looking beyond the sector to the national and international economies to understand the forces that affect fisheries. Now lets come back to fisheries science and how it is supposed to help make fisheries sustainable in the face of all this. Is the poor state of the resources in any way the fault of fisheries science? Has fisheries science not been providing the right advice to the resource managers and users? My answer is 'no' followed by a caution, however, that fisheries science will have to change itself in the future if fisheries are to have a sustainable future. Let me then explain why science cannot be blamed for fisheries problems to date and then spend the body of my address on the what I see are some of the changes that scientific institutions and scientists will have to make to make a difference for the future.

Why is fisheries science *not* to blame? The supporting facts are many and I draw my analysis from the work of the scientists themselves as revealed in the monumental 8 country study just completed (Silvestre et al 2003a).

For a start, the fisheries scientists of the region had (and have) very sparse data with which to work, and even where these data were more comprehensive, such as in India, too few analyses were undertaken. The most important and unbiased information on the resource should come from fishery-independent surveys. These were particularly rare, given the costs of undertaking them, and the collection of data by logbooks from commercial and small scale operators is not feasible in the same way as in the highly regulated and large scale industrial fisheries of Japan, Europe, the United States of America and Australia.

Next, the fisheries management institutions of the Asian countries are not yet set up to control the amount of fishing effort on the resources, but more to help develop the industry. Management regimes that exist are often based on management zones that do not match the spatial patterns of the fisheries assemblages being managed, although they were usually designed to reduce conflict between different fishing gears (Silvestre et al 2003b).Throughout the 1990s, as the realization grew that the Central management alone would not work, the countries began to experiment with decentralized management regimes and power sharing through co-management, with the Philippines and Bangladesh standing out as the leaders in beginning this experimentation. Fisheries rights regimes have not developed to cope with the increases in fishing. License control is non-existent or loose in most countries and many fisheries still act like open access commons. When fishers are displaced by other bigger operators or developments such as new ports and land reclamation, compensation, if paid, may not make up for the life time loss in informal fishing rights.

From the perspective of science agencies and scientists, the countries still lack formal institutional mechanisms for seeking and providing clear scientific advice to the managers in the fisheries departments. Thus, scientific advice and information on the state of fisheries are given in an ad hoc fashion and may not be called for at all if they are likely to lead to difficult political situations. Non governmental environmental organizations and regional and international research agencies operating in Asia (e.g., SEAFDEC, WorldFish Center) have been more likely to be talking publicly about the state of the fisheries than the national research agencies who hold the available information. Thus fisheries scientists and science agencies have been working in an institutional vacuum that lacks formal and prescribed means for their research and monitoring results to be communicated to fisheries management.

Coupled to the lack of basic fisheries information and the lack of institutions to interface the scientific advice with the fisheries management needs has been the extraordinarily rapid pace of fisheries development. The threefold increase in the number of Asian fishers from 1970 to 2000 only tells part of the story of the growth of fishing because each of those fishers has been fishing with gear of increasing greater – from natural fibre to monofilament nets, from hand hauling to electric winches, a great increase in trawling and trawler fishing power by all means and boat engines that take fishers further, faster. Demand for fish from growing populations has also placed enormous pressures on the fishers to fish harder and has placed enormous pressures on the environment to sustain the fisheries resource. Economically and industrially, Asia has been and continues to be the growth region of the world.

Therefore, lacking sufficient information on the fisheries, without formally recognized conduits for providing scientific advice to fisheries managers, and faced with very rapid economic and physical development, fisheries scientists and research agencies cannot be held responsible for the present state of Asian fisheries. However, if, as fisheries scientists, we cannot find a way to help make the future of fisheries better and more sustainable, then we lose our reason for being.

I have three remedies, all of which are complementary and need to be addressed at the same time, so that fisheries science can have a positive impact on the future of Asian fisheries.

The first remedy is to transform the research agendas of fisheries institutions and funding agencies to directly target finding solutions to the fisheries problems. Second, develop the right national and regional institutions to carry out the new research agenda and deliver its results where they can be used in a form in which they can be used. And third, make a long term commitment to collecting, analyzing and making accessible the data and information necessary to support fisheries management. I will now address each of these 3 remedies and suggest specific actions for their application.

Transforming Research Agency Agendas

The general directions for fisheries research agencies to follow are already available in environment and development agendas of recent years, especially those at global and regional levels, e.g. the FAO Code of Conduct for Responsible Fishing, the Plan of Implementation for the 2nd World Summit on Sustainable Development and the Sustainable Development Strategy for the Seas of East Asia. These global and regional codes, strategies and plans, plus the national priorities set the context within which national level equivalents are made, and they also provide the targets for fisheries research agendas.

How can Asian research institutes and researchers use the statements as guides to transform their research agendas? And what factors and trends in research more broadly offer opportunities for finding solutions?

Research agencies could start reformulating their research agendas by first establishing their own conceptual frameworks for research priority setting. A typical framework would contain at least the following elements:

- The global/regional/national goals for sustainable development in the agency's mandate area, e.g. Cambodia inland fisheries, Philippines coastal fisheries
- Other relevant objectives such as national fisheries sector objectives, science and technology priorities, social welfare and community development objectives, etc
- Fisheries research objectives, available and potential research resources (people, ships, laboratories, funds, partners), constraints and opportunities, including opportunities offered by new scientific developments such as biotechnology, economic modeling, ecosystem approaches to fisheries science
- The smallest possible list of criteria for measuring success
- Agreed assessment processes for using the criteria to recommend choices among different research projects

This approach has been used for decades by agricultural research agencies and is only now making its way into fisheries research through such organizations as the WorldFish Center. Priority setting is akin to ex ante impact assessment and addresses one end of the research-development-adoption-impact continuum while ex post impact assessment addresses the other end, with research monitoring and evaluation addressing the part in between (Ahmed, et al 1999). The great benefit of using formal ex ante priority setting and ex post impact assessment is that they enables researchers to say to their Director General or to a research granting body, 'this is how my project will benefit the economy, the environment, the community and the fishers' or 'this is how much benefit has accrued from the results of our research' Funding agencies focus on learning, as precisely as possible, the likely and actual benefits from their funding as they need this to convince their governments and others that donate their funds that the money they are spending is making a difference (e.g., ACIAR 2004). Indeed, such agencies as ACIAR are inculcating an impact assessment culture in their organizations.

An additional impetus for fisheries scientists to become involved in impact assessment of their work is that their colleagues in aquaculture research are likely to already be doing this, or at least will have an easier time in showing the benefits of aquaculture development. Often the internal priority setting decisions will be on how much resources should go to aquaculture research versus how much to fisheries research. In terms of methods for priority setting and impact assessment, Braunschweig et al (2001) stressed that, whatever the priority setting method used, careful attention must be given to the construction of the criteria at the heart of setting your priorities and assessing impact.

For parts of Asia, a giant step towards defining research priorities was made by the recently completed project on the 'Sustainable Management of Coastal Fish Stocks in Asia' using the following simple pathway (Figure 1) to reach agreed management interventions. This project started essentially with the Code of Conduct for Responsible Fishing and Agenda 21[4]. National research agencies and research investors now need to take this intervention pathway a step further and identify researchable issues that can be developed into research programs and projects to support and guide the management interventions.

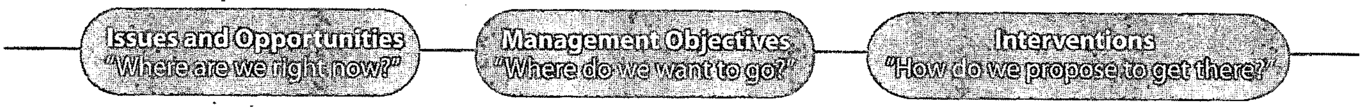
Issues and Opportunities
"Where are we right now?"
Management Objectives
"Where do we want to go?"
Interventions
"How do we propose to get there?"

Figure 1:[5] A logical approach to developing appropriate management interventions

To determine high priority researchable issues, agencies need to develop research projects to address the issues and find the resources with which to do the projects. Some of the project resources will come from their existing resources and others will have to be raised from outside sources, such as national or international competitive grants programs. A critical resource part of the resources will be those that can be redirected from existing projects that are judged as being of lesser importance. Redirecting resources is often the hardest step as it means that those involved in the less important work will be subject to the changes, and change is always difficult.

The apparently simple table of interventions developed by the Coastal Fish Stocks project (Table 2) contains a wealth of clues for setting fisheries research agendas and even for single research projects in, say, universities. For example, the first intervention, 'Integrated Coastal Fisheries Management' and its second objective, 'Integrity of the environment' could be used in a particular locality for developing research projects that address the local fisheries-environment issue, say construction of a yacht marina that destroys seagrass fish and shrimp habitat. Furthermore, the intervention and the objective also suggest institutional pathways through which research results may be delivered.

Table 2: The objectives pursued and issues addressed by the proposed interventions at the national level[6]

Intervention	Objective(s) Pursued	Issue(s) Addressed
Integrated Coastal Fisheries Management	Integrity of the resources	Depleted coastal fishery resources, loss of resource rents, excessive fishing effort, harvesting immature/undersized fish, destructive fishing
	Integrity of the environment that sustains the resources (Integrity of critical coastal habitats, biodiversity)	Degraded coastal environment and critical fisheries habitats, harvesting/conversion of mangroves
	Maximize economic benefits from the utilization of the resources	Intersectoral and intrasectoral conflicts, inequitable distribution of benefits from resource use
	Minimize resource-use conflicts	Lack of compliance with regulations, low level of stakeholder participation
Supplemental/Alternative Livelihood for Artisanal Fishers	Minimize poverty among artisanal fishers	Poverty among artisanal fishers, few alternative livelihood options
	Integrity of the resources	Depleted coastal fishery resources, loss of resource rents, excessive fishing effort, harvesting immature/undersized fish, destructive fishing
System of Aquatic Protected Areas	Integrity of the resources	Depleted coastal fishery resources, harvesting immature/undersized fish, destructive fishing
	Integrity of the environment that sustains the resources (Integrity of critical coastal habitats, biodiversity)	Degraded coastal environment and critical fisheries habitats, harvesting/conversion of mangroves
Minimizing By-catch and Post-harvest Losses	Maximize economic benefits from the utilization of the resources	Opportunity losses, post-harvest losses
Capacity building and institutional strengthening*	Strengthen national institutional capabilities/ linkages	Weak law enforcement, inadequate fisheries policies, inadequate infrastructure/equipment, information/research inadequacies, low utilization of research/information

Note: * Capacity building and institutional strengthening are suggested as a general recommendation. No specific activities have been specified.

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4 The Project pre-dated the 2002 Johannesburg 2nd World Summit on sustainable Development and so its global context was set more by its predecessor, Agenda 21 produced by the 1st World Summit on sustainable Development in Rio de Janeiro in 1992.

5 From p. 23 Silvestre et al 2003

6 This table is Table 21. p. 37 from Silvestre et al 2003b

Thus, by starting at the higher level needs and directions, and seeing the research in this larger societal context, not only are the research ideas indicated, but also the pathways to their adoption.

If agency research agendas are derived from fisheries problems and needs, how then do new scientific approaches make their contribution?

Each day, new discoveries, new theories, new methods and new concepts are being developed, presented at conferences, published and debated. Some scientific breakthroughs will eventually help make a difference in fisheries. In addition, changes in the world around us will often stimulate scientists to think and work differently – and the current state of Asian fisheries is one such stimulus. Keeping up with the frontiers of fisheries developments and fisheries-relevant science is a huge challenge but, nevertheless, it is the scientist's responsibility to stay up to date. The final choice of research topics and methods to address the fisheries issues will be made by the scientists and these must be well informed. Large conferences such as this triennial Asian Fisheries Forum, are one way, among many, to find out what the latest buzz is in fisheries and fisheries science.

Other good ways to assess current trends is to see what ideas are being hotly debated – where experts do not agree with each other – and where the reality of research priorities does not match the rhetoric of the research needs. In my view, three trends fit these 2 criteria: conceptualizing fisheries resources as a part of the natural ecosystem, considering fisheries as an activity embedded not just in the environment but also in the social and economic fabric; and addressing the questions over fishing rights in every fisheries management action.

Fisheries in the ecosystem: Experts all seem to agree on the basic premise that the whole of ecosystem approach is needed. However, little research is yet being done specifically on this topic in the Asian region. For example, Silverstre et al (2003a, b) were only able to report very preliminary work on ecosystem modeling in the 8 Asian countries and much more needs to be done to build the capacity for ecosystem approaches. The concept of ecosystem-based approaches to fisheries management and research is subject to hot debate among some of its leading edge thinkers, as seen in recent publications (Longhurst 2003a, b, Sherman et al 2003, Browman and Stergiou 2004). The application of the concept in fisheries management is also contentious as witnessed at the 2003 FAO meeting of the Committee on Fisheries (Williams 2003). It can be variously interpreted as providing the support for balanced harvesting of marine mammals and all other parts of the marine food web, as giving primacy to environment over human uses of aquatic life and it leads to fear that the data and research needs are so vast they will never be met.

Fisheries in the community and economy: Integrated fisheries management and integrated coastal management are praised. Last year at the Ministerial meeting following the East Asia Seas congress 2003, only 1 of the 12 signatories to the Putrajaya Declaration (2003) had responsibility for fisheries (Korea), and then the responsibility was only part of a broad marine affairs portfolio. No fisheries ministers attended in person, although fortunately there were many fisheries scientists present. Fisheries has to make its voice heard much more in economic and community spheres of influence, including science and technology, coastal zone, trade, agriculture, health, gender and human development. More than this, fisheries research will need to make a major transition in its way of working and take up more of the approaches of current human development research (Williams 1996, Williams 1998, Bene 2003). In Asia, a key issue is the fast expanding uses of the fish resources, going beyond the dominant use as food to greater use for sport, tourism, ornamental fish, and conservation.

Fishing rights: Open access fisheries and lack of explicit fishing rights are now much more recognized as the address the rights issues and therefore do not get at the core of the role of rights in the success or otherwise of management. Bene (2003) alluded to the importance of exclusion from fisheries rights as the defining factor in the welfare of people, rather than the actual status of the fisheries resource.

In summary, then, to succeed in making the best contribution to sustainable fisheries, fisheries research agendas must be consciously reformed to target the fisheries research needs of fisheries, environmental and social strategies and plans. Research priorities should be set using appropriate frameworks and research priority setting and impact assessment methods. Fisheries scientists need to stay abreast of the latest methods and developments so that they can design the most relevant research agenda to address the goals of the strategies and plans.

Develop the Right Institutions to Carry Out the New Research Agendas and Achieve Impact

The culture[7] and the institutions[8] within which research is performed, and its results communicated, are integral to its impact because scientists are people and scientific research institutions and scientific work is a collaborative social, economic and intellectual enterprise. Not only does science have its cultural dimensions, but so too do different scientific disciplines, research agencies, universities and consultancies and countries.

Three key factors in building the right institutions for carrying out effective fisheries research are, first, building the capacity of the research agencies and their staff, second, increasing the cooperation between scientific disciplines and across sectors, and, third, creating culturally appropriate ways for planning and delivering the research agenda.

The capacities of individual scientists and of their institutions are important factors in the impact of science. In 2002, the FAO Advisory Committee on Fisheries Research (ACFR) recommended that capacity building in fisheries was the first priority for attention by FAO and other fisheries agencies. ACFR (ACFR 2003) placed this above all other research topics – as a 'Mega Priority Cross Cutting Issue' - in light of the great number of changes occurring in the sector, including in research. Training and education in the new approaches and developments are currently not covered in standard courses. These include community based management, co-management, participatory and livelihood approaches, protected areas management and ecosystem based approaches.

Within research agencies, more rigorous priority setting will also help strengthen agency capacities. If properly conducted, they expose many staff, stakeholders and partners to thinking about and deciding what research will make an impact, how this will be achieved and the criteria by which impact will be judged.

In priority setting, agencies must ensure that the human dimensions of fisheries are also taken into account. This sounds obvious and trivial but experience shows that scientists often come with strong 'disciplinary blinkers' making for deep divisions between the disciplines. Sometimes knowledge can be bridged across the divide by each discipline including key links to the other disciplines, as we discussed when reviewing the multidisciplinary Population, Consumption, Environment Initiative of the Macarthur Foundation (Agardy et al. 2002), e.g., anthropology and economics papers containing scientific names of the fish being caught and marketed.

Recently, I had a sobering illustration of the discipline divide when a fisheries anthropologist I was introduced to referred me to Raymond Firth's book, 'Malay Fishermen' (Firth 1966), when he learned I was living in Malaysia. On reading this anthropology classic - note, not just a fisheries anthropology classic- I discovered that most of my fisheries biologist and economist friends did not know the work but that, literally to a person, my (non-fisheries) anthropologist colleagues were fully familiar with the work. The knowledge divide, in this case, was along disciplinary lines and not on sectoral lines.

Sectoral divides are also important to fisheries research. Scientists and agencies will have to be more outward looking and learn to connect with their peers and stakeholders in other sectors such as conservation and tourism.

Other 'divides' also exist, such as the 'gender divide' that assumes that women in fisheries or gender and fisheries studies should be mainly of interest to women, even if these women are experts in the bio-physical disciplines. Many of you will remember the very first Asian Women in Fisheries Symposium at the 5th Asian Fisheries Forum in 1998 (Williams et al 2001). In conversations among delegates at the Forum in the days before the Symposium, many of our male colleagues asked those of us involved, 'can men come along too?' This comment was meant as a joke and we took it in good spirit, but, I am delighted to say, the irony is that the whole concept of getting the Asian fisheries science community motivated to seriously consider gender issues came from an eminent and far sighted Indian fisheries expert, Dr M.C Nandeesha!

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[7] Culture: a complex of typical behavior or standardized social characteristics peculiar to a specific group, occupation or profession, sex, age grade, or social class; the body of customary beliefs, social forms, and material traits constituting a distinct complex of tradition of a racial, religious, or social group; that complex whole that includes knowledge, belief, morals, law, customs, opinions, religion, superstition, and art. From the Merriam Webster Unabridged Dictionary.

[8] Institution: a significant and persistent element (as a practice, a relationship, an organization) in the life of a culture that centers on a fundamental human need, activity, or value, occupies an enduring and cardinal position within a society, and is usually maintained and stabilized through social regulatory agencies. From the Merriam Webster Unabridged Dictionary.

To overcome the discipline divide, new approaches, such as ecosystem based fisheries, must reach out to an appropriate disciplinary mix. Also, project planning should include relevant disciplinary experts, rather than encouraging biologists to try to address all disciplines as now tends to happen. Broader education of fisheries scientists is needed to introduce students early to the basics of the social sciences and the utility of development concepts, as successfully demonstrated by Bene (2003).

Other capacity building measures that help build strong institutions are training research managers in leadership skills, research and project management. Upgrading and updating technical know-how should be a life long responsibility of each staff member, although agencies can help by supporting their staff to upgrade their knowledge.

This far, this section has what happens within agencies. However, institution building beyond the walls of the agencies is equally critical to integrating fisheries research with its end uses. Inclusive research planning and delivery mechanisms can help build not only the research agency but also the broader institutions required for sustainable fisheries.

The critical institutions to build are those that enables scientific advice to be routinely provided, in an actionable form, to the fisheries decision makers, the fishers and the public. In Europe, North America, Australia, formal bodies such as fisheries management councils and research advisory committees are associated with particular fisheries or regions. These bodies formally define processes and responsibilities for developing and providing technical advice to the fisheries managers. The form of that advice has evolved with experience and it is usually publicly available and often condensed into annual status reports (e.g. Caton 2002). Such bodies are rarer in Asia and tend not to have the formal status or the possibility for the research experts to learn from each other and refine the approaches used for local and national conditions, in the same way that happens, for example, in the institutional setting of the more than 100 year old International Council for the Exploration of the Seas (ICES).

However, the ICES processes also carry a valuable lesson since their highly refined stock assessment recommendations have not been adequately used by the fishing countries of the European Union, the United States and Canada, raising fundamental questions of how they could have been more effective. The modernization of the advisory process is one of the highest priorities of the current President of ICES (Sissenwine 2004). An American fisheries historian, Tim Smith (1994, 1998) lamented that, throughout its first nearly 150 years, fisheries science did not seriously study fisheries management, warning that such a lack of focus on the whole of fisheries had left fisheries science ineffective in the past and unless addressed, would continue to do so. In building their own institutions for the delivery of research advice, Asian fisheries research agencies should heed the lessons of what has and what has not worked in other countries and regions.

The broader approach to research agenda setting requires that agencies and scientists include their stakeholders in research planning, delivery and evaluation. Participatory processes in research also mirror participatory approaches that are developing in fisheries management (e.g., Vishwanathan, et al 2003). However, despite the more participatory approaches, the lack of established pathways for the delivery of fisheries assessments in Asia still means that the news about the state of fisheries and fisheries resources is not getting through to those that can act or create the space to act. This was well shown by the Coastal Fisheries Management project (Silvestre, et al 2003b). None of the data used in the 8 country-study were new. Much of it had been used and analyzed before. The study did put it together in a consolidated and comparative way but, still, its conclusions should have surprised nobody. Yet, when discussed recently at the Asia Pacific Fisheries Commission meeting in Thailand (FAO 2004b), the report raised awareness as though the results were new. This suggests that the intermediate products, such as national reports, were not well enough known.

Finding culturally appropriate ways to deliver the controversial or bad news about fisheries, as well as the good news, is a challenge. Among different cultures, great differences have been recognized with respect to the way that people interact within organizations, the family and in the country. A standard reference on the topic (Hofstede 1994), examines such culturally important dimensions such as the power distance between individuals. Countries differ with respect to these characteristics, so that Japan and Korea, India and Bangladesh, the Philippines and Vietnam, the United States and Sweden, all have different dominant cultural styles. These cultural differences matter to how fisheries management institutions could be designed to enable the effective two-way flow of fisheries research advice to key stakeholders. In countries where the power distance between the Director General of Fisheries and a middle ranking scientist is large, the scientist's professional expertise may not be as important as her rank, or even gender. The channels for conveying advice must then be set up to still ensure that the Director General still gets the advice needed.

One advantage of the ICES stock assessment approach is that it's collaborative and peer reviewed assessments provide the safety of group advice as well as peer review of the advice by relevant experts. The possibility does exist in Asia of such regional and group mechanisms through the FAO. The recent Asian Pacific Fisheries Commission *"..unanimously agreed that APFIC should function as a Regional Consultative Forum (RCF) to provide a framework for Members to discuss fisheries issues which affect groups of States across the wider Asia-Pacific region and to formulate recommendations for action. In this context, APFIC could act as a platform to discuss emerging issues relating to fisheries, trade and sustainable management facing its Members."* In my view, this creates a good opportunity for FAO and the countries of Asia to develop new technical forums for serious resource management discussions on the region's fisheries and I urge all concerned to make this happen urgently, given the status of the region's fisheries. Action, of course will still need to go back to the countries and to local grass-roots communities, but it will do so with the support of open processes for scientific advice and governmental support.

In summary, capacity building of institutions with fisheries research agencies, and at large are central to the Asian region's capacity to sustain its fisheries.

Get the data and information needed by scientists and the stakeholders and make it accessible

Fisheries science will never be able to show impact without collecting the raw material on which to build success – namely information based on data and published results.

The computer and internet age has created the technical environment for low cost storage and long term maintenance of data, although nothing will substitute for the human commitment to define and collect the basics, such as catch, effort, prices, length and weight of fish, etc. Fisheries databases are developing, often despite a lack of appreciation of their great importance to science and management. The ACFR has emphasized the importance of data and data quality and initiative international work that resulted in the Strategy for Improving Information on Status and Trends of Capture Fisheries (FAO 2003b). Projects such as the Sustainable Management of Coastal Fish Stocks in Asia and similar national efforts are resurrecting valuable scientific data, some going back to the 1920s (Table 3). As fisheries develop and aquatic ecosystems change, such information should be considered part of the national heritage, to be retained and used to establish historical resource baselines to aid understanding of how humans, climate and the ecosystem itself have wrought changes which carry lessons for the future (Holm 2003). As scientists learn more about cause and effect in marine ecosystems, all data, especially historical data become increasingly important to inform our knowledge of the present status (Jackson et al 2001).

A final critical factor in the accumulation of knowledge to support good fisheries science, is the need to publish openly so as to make that knowledge available. The Asian Fisheries Journal and numerous special publications of the Asian Fisheries Society and its partners are valuable contributions to this imperative. Although the academic ethos of 'publish or perish' has too often been derided as taking valuable research attention away from the dissemination and application of the results, publishing is an essential part of codifying and passing on valuable knowledge gained from research. Publishing is not and end by itself but when research results are not published, there is a serious risk of them being lost and the research having no impact at all. Publishing also adds to the reputation of the scientists and their research institutes and indirectly adds to the credibility of the research results.

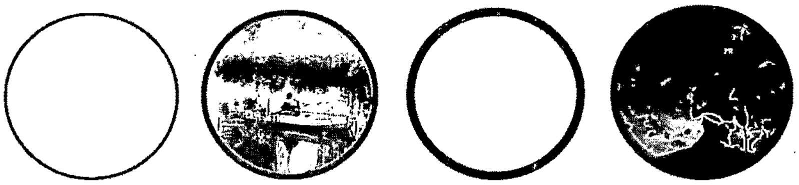

Table 3: The trawl surveys contained in the database system (FiRST ver 2001) for each country)[9]

Country	**No. of Cruises**	**No. of stations**	**Years**
Malaysia	177	4 418	1926 - 93
Philippines	125	838	1947 - 95
Thailand	106	5 890	1968 - 95
Singapore	42	925	1969 - 73
Indonesia	2	1 376	1974 - 79
Myanmar	4	375	1979 - 80
Bangladesh	55	1 450	1980 - 88
India	12	613	1994 - 95
Sri Lanka	16	618	1920 - 80
Vietnam	84	4 021	1979 - 88
Pakistan	5	96	1976
TOTAL		**20 620**	

A recent study on publishing patterns in Asian fisheries and ocean science by Arunachalam and Balaji (2001) compared China and India and found that fisheries scientists in both countries published predominantly in domestic journals (78% in China and 70% in India) and international journals with low impact factors. They noted that Indian publishing outranked Chinese publishing on most scores and remarked that, despite this, China's fish production growth was much more vibrant. In terms of capture fisheries research, however, fish production growth would not be the appropriate measure for the success of science publishing and the science – indeed the reverse may well be true. Given the state of fish stocks, fisheries science may be deemed more successful when it is used to persuade fishers and governments to reduce the catch to achieve longer term gains. Another study (Dudgeon 2003) remarked the low publishing rate in Asian freshwater biodiversity research. Dastidir (2004) showed the dominance of the United States of America, Japan, France, Germany, United Kingdom and to some extent Australia, Canada and Russia in research and publishing linkages in ocean science and ascribed the dominance to economic power.

Somewhat reinforcing Dastidir's view for science in general, Cyranoski (2004) reported the economic rise in China is being paralleled by an explosion of Chinese science being published in international journals. China now accounts for over 5% of the world's scientific papers, growing at a rate much greater than that of other Asian countries. We do not know in these figures for all science, however, whether fisheries science is also growing in its numbers of publications.

In summary, for fisheries science to make a difference in the sustainability of fisheries, more attention is needed to capturing and maintaining basic data and information, coupled with greater attention to publishing the results of research to make it available and increase its accessibility, reputation and credibility.

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[9] Table 2 from Silvestre et al (2003b)

How to make a difference with fisheries research

Transforming research agency agendas to target their work to fisheries problems, building institutions and the capacity to address the new research agendas and paying attention to the basic information needs of fisheries research and management are three complementary fields of action.
What could you do to help make the necessary changes and be able to tell your grandchildren about your role in making Asian fisheries sustainable? Of course the answer to this question depends on your role. Let me therefore conclude by making a few suggestions for each of the main roles that you might have as an agency director, research manager, scientist, or investor in research.

If you are an agency director, look carefully at how your agency presently plans and carries out its work. In planning and delivery, do you have the right level of integration with the key stakeholders, such as the fisheries managers, the fishers, the researchers in other disciplines not covered by your agency and with experts in other sectors such as ports or tourism? Although not all your work will be done in an integrated way, decisions to 'go it alone' should be deliberate. Are you clear about the targets of your work and how you would measure the success of your agency? Are your staff able to use the new research planning methods and, if not, how can you develop them to do be able to undertake priority setting and impact assessment? Do you have the resources to achieve the changes and, if not, how can you redirect existing resources or raise new ones?

If you are a research manager, how does the work of your program fit into the agency as a whole and into the needs of research in this topic? If you are leading purely biological work, are you missing the social dimensions of issues? Who will need the results of your program's research and in what form? Do you understand the intended steps and intermediate products that are necessary to make your research conclusions relevant to fisheries stakeholders such as the minister and to stakeholders in other sectors such as conservation and tourism? How can you make better links to the users or other researchers? Are you giving your staff the support they need to do their jobs? How are you going to get them the results?

If you are a fisheries scientist, do you understand enough of the 'bigger picture' to be able to target your research products to make a difference? Do you keep abreast of developments in you own fields, as well as developing broader knowledge? Are you taking enough responsibility for your own knowledge and skills development or are you waiting for your agency to do it all for you? Are you networking enough? Do you have a career mentor?

If you work with an investor agency, is your agency's portfolio of fisheries projects integrated with the needs of the country and key stakeholders? Are you taking enough account of capacity development needs of the researchers? Do you really know the impacts of your projects on making fisheries more sustainable?

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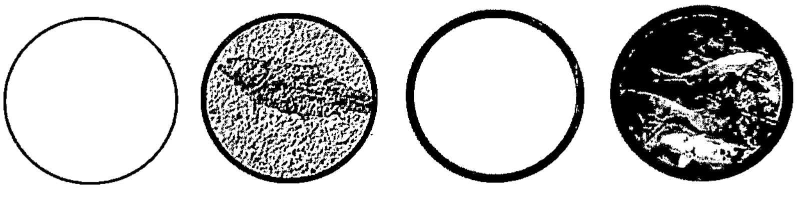

Globalisation and its Impact on Asian Fisheries
– Implications for Fisheries Management

Mahfuzuddin Ahmed[1]

Globalisation and Asian Fisheries

The phenomenon of globalization is one of the most interesting and hotly debated issues in the World today. One of the most obvious manifestations of globalization is that growth in world trade has outpaced growth in world output during the entire postwar period (Diaz-Bonilla and Robinson 2001). Fish too has caught up with the globalization. The liberalization of trade has integrated many local and domestic fisheries with foreign markets. With the rapid rise of fish exports from developing Asia fish has become one of the major developing country trade stories in the later part of the twentieth century. Globally, fish trade is nearly 60 billion US dollars market. The aggregate value of net fisheries exports from developing countries to developed countries now exceeds the combined value of net exports of coffee, tea, banana and sugar (Delagdo et al. 2001). Asian countries are dominant players in global fish trade. Fish exporting countries are constantly racing for capturing a bigger share of the growing world market for fish and fish products.

The prospects of huge gains from trade such as alternative source of fish supply to domestic consumers through imports and favourable terms of trade and higher export earnings to exporting countries have been conditioning the minds of policymakers on both sides of the isle – importing and exporting countries, developed and developing countries. Countries are also increasingly worried about many negative consequences of globalization and increased integration with foreign markets ranging from risking domestic nutritional security and consumer welfare to threats to sustainability of fisheries resources. On one end, high price and high demand situation made fishery a major contributor to the national macro- and export- economy. At the other end, it exposed the fisheries to higher degree of exploitation that made many fish stocks become vulnerable to depletion due to increased effort and selective harvesting. The implications of these opposing trends for fisheries management are massive. Overdependence on few developed country markets, volatility in international demand and prices, and heterogeneity in policies including those that relate to food safety and other forms of non-tariff barriers are increasing risks and adding costs for Asian fish producing countries. Increasingly the blame is given to the politics of trade and consumption in which liberalization (removal of tariff protection) and barriers (non-tariff barriers) have taken a new form of deceit and deception. The comparative and competitive advantages of developing countries in fish production and export are being threatened by newer forms of barriers having significant implications for the viability of Asia's export-focused fish sector and sustainability of the fisheries resources.

Globalization means different things to different people. Some people refer to it as rising economic, political social and cultural linkages among people, organizations, and countries at the global level. Others interpret it as a tendency toward wider application of economic, political, social, cultural, institutional and legal practices. These are, however, not entirely new phenomena. In deed, the previous wave of globalization associated with modern economic growth took place in the second half of 18th Century and early 1900s that brought the level of world integration to a peak. It, however, ended in pain and disintegration with two world wars and a global economic depression between them. In the post world war era the world began as being divided politically and militarily. Soon another process of economic, political and social integration emerged with rapid changes in the generation, adoption and diffusion of technology. Economic deregulation and liberalization by the end of Cold war further accelerated the economic, social and environmental linkages (Diaz-Bonilla and Robinson 2001).

Dramatic Shifts of Production, Consumption and Trade

All of us are in one way or other witnesses and participants to the globalization and many of the fundamental changes that globalization brought to fisheries around the world in its recent history. The world observed an unprecedented rise in production, consumption and trade of fish during the last three decades. Globally, the total fish production doubled to 130 million tons in 2001 from the level of early 1970s. Developing countries as a whole now supply nearly 75% of the fish, and represent 50% of the value of global fish trade. Asian developing countries alone produce 56% of the total fish. (FAO, 2004). Many Asian countries experienced high growth in per capita fish consumption over the past two decades. The per capita annual consumption of fish increased substantially in China, Bangladesh, India, Thailand, Indonesia and Vietnam during the last two decades. China experienced by far the fastest growth in per capita fish consumption. In two decades the per capita consumption jumped more than 300% with an annual average growth rate of 9%. Although per capita annual consumption of fish is much lower in India (4.5kg in 2000), it increased over the last two decades, from an average 3.2 kg per capita during 1981-1990.

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There are several factors that made Asia's fish production, consumption and trade rise to the status of a global sector. However, developments in three interrelated areas - technology, policy and markets – had been the primary drivers of the globalization of Asian fisheries. Firstly, the phenomenal growth in the supply of fish was triggered by the huge expansion of fishing in coastal and inland waters and open seas, and technological breakthroughs in aquaculture driven by increased demand for fish in the world market, and simultaneous changes in international laws, treaties and institutions such as EEZ and UNCLOS. Secondly, structural reforms in many developing and transitional Asian economies (e.g., China, Vietnam, India and Thailand) inspired by the new era of globalization and liberalization also contributed to the shifts in the structure of production, consumption and trade in fish. Aquaculture, regarded as one of the greatest technological and policy successes in agriculture the last quarter of the 20th century, grew from only 3.9 million tons in 1971 to 42 million tons in 2001, most of which came from Asian countries. Aquaculture now represents one third of total production from barely 6% in 1971. Finally, a significant aspect of the changing structure of the fish sector is the trade of fish and fish products between the developed and developing countries that has changed both in composition and direction in the last two decades. The developing countries increased their net export by 283% from US$6 billion in 1980 to US$23.3 billion in 2001. Developed countries imported 82% of the total value of global fish imports. Japan, EU and USA together imported 77% in 2001.

As I mentioned earlier, the current value of global fish trade estimated at $60 billion has surpassed many traditional agricultural exports. At a time when receipts from traditional agricultural exports have been declining, export earnings from fish seem to be paying for the food import bills in many low-income food deficit countries (LIFDC) or net food importing developing countries (NFIDC). Developing Asian countries continue to record an impressive trade surplus in fish products. In 2001, in value terms these countries contributed about 32% of world fish exports but only about 14% of world fish imports. The net fish exports (value of fish exports less the value of fish imports) from developing countries increased substantially over the last few decades and reached nearly US$10 billion in recent years (FAO 2003). The value of fish exports from Vietnam, a small and non-traditional fish exporter, has increased from only US$0.81 million in the mid-1980s (average of 1985, 1986 and 1987) to more than US$2 billion in 2002 (FAO 2003). For many of these nations, fish trade represents a significant source of foreign currency earnings and delivers benefit at both the macro and microeconomic levels. This is one of the major considerations for national policies in developing countries to keep pressing for higher fish exports.

Consequences on Fish Resources

Trade induced demand is viewed as one of the main reasons for increased fishing pressure in Asian Fisheries. Excessive removal of target species and non-targeted species has not only caused overexploitation of specific species, it has also caused a wider ecosystem impact affecting predator-prey relationships and community structure. In most fisheries we now observe less of the long-lived species and more of the short-lived opportunistic species (Brown and Ahmed 2004).

Rising trade is also one major reason behind the expansion of live reef food fish (LRFF) fisheries in the Indo-Pacific region (Sadovy et al. 2003). As a consequence, populations of the most desired fish in LRFF trade, the groupers, are already heavily fished. Collection of fries and juveniles for grow out operations while provided an alternative source of supply, it has evidently produced further significant pressure on the population of a number of species, such as grouper and shrimp.

The rise of aquaculture has added to the complexity of management of already complex wild fish stocks through its interaction with capture fisheries and coastal environment. Likewise, the rise of illegal, unreported and unregulated (IUU) fishing has added an additional international dimension to the complex management of marine fisheries by Asian by fishing nations.

Fish Supply and Demand in Changing Global Markets

Policy researchers and economists at WorldFish Center and the International Food Policy Research Institute (IFPRI) used a global model of supply and demand for food and feed commodities to project the likely changes in the fisheries sector over the next two decades given present trends (Delgado et al., 2003).

The model projects that total food fish supply alone will be 130 million tons in the year 2020, an increase by 40% from the base period 1997. Developing countries will continue their dominance over the production of low value food fish, whether in aquaculture or capture. It revealed a burgeoning demand for fish in developing countries. Likewise, the structure of supply will further shift toward aquaculture as well as toward developing countries. By 2020 aquaculture may supply nearly 41 to 51% of the total production, while developing countries would continue to lead in both production and consumption of food fish. Food fish supply in China and India alone are projected to increase by 59% and 67%, respectively. Developed countries' share of food fish to the global total will reduce to 21% in the year 2020 and the remaining 79% will split between China and the rest of the developing world at the rate of 41and 38%, respectively.

The projection results by Delgado et al. (2003) also show a significant increase in the prices for food fish, fishmeal and fish oil. Fish are highly likely to become more expensive to consumers compared with other food products in almost all scenarios of projections. Faster aquaculture growth which assumes a much higher technological and policy success is the only scenario that may lead to a drop in the real price of low-value food fish. But, the latter scenario will cause an increase in the prices of fishmeal. Slightly lower prices of fishmeal and fish oil can be expected only through improving technical efficiency in their conversion.

Net exports from the developing to the developed world are projected to continue through 2020, though at a lower level than at present, mainly because of rising domestic demand for food fish within Asian developing countries in response to urbanization, and population and income growth. More and more Asian developing countries will be involved in regional (south-south) trade, the Africa region as a whole and part of south Asia (excluding India where fish is less important in the daily diet in the majority of the population) will become net importers.

While these trends are likely to continue to 2020, questions are being raised about the integrity of world's oceans and fisheries as well as the true role of fisheries in poorer developing Asian countries in eliminating poverty and improving nutritional security of the poor. The biomass of most fish populations has reached to 20% of pre-fishing levels within 15 years; the biomass of large predatory species is now only 10% of pre-industrial levels (World Bank 2004). Many people believe that a huge environmental crisis is looming, while the root cause of the crisis is failure of both perspective and governance, according to a report by the Pew Oceans Commission (2003). According to Delgado et al "the world's fish sector may become a victim of its own success" (Delgado et al., 2003).

Overall, an excess demand situation (where demand will outstrip supply) will create a sharp increase in the fish price. Poor people are likely to feel the pinches of higher fish price, as prices of many low-value food fish are also likely to increase. Only through a faster growth of aquaculture than at present can the world expect a modest decline in the fish. Emphasis on higher export earnings from fish encouraged by lucrative international markets may make domestic fish resources, especially high-value species in developing countries more vulnerable to over exploitation. Efforts to recover stocks that are already deteriorated may be sacrificed or traded for short-term economic gains.

Implications for Fisheries Management

Although trade is blamed for inducing overfishing and use of damaging production methods, including IUU fishing, some of the key resource problems arose due to the absence of good management. Trade has merely exacerbated these problems. In the remainder of the paper I will discuss the implications of the globalization for fisheries management, especially when countries lack an effective management regime. Several observable characteristics such as type fish population, number of people with access to fisheries, state of harvesting technology, discount rate of harvesters and status of monitoring will determine what the likely effects of trade liberalization will be. For example, most vulnerable countries are those with slow growing fish species or fish population, large number of people dependent on access to fisheries, modern harvesting technology, poor monitoring and harvesters with high discount rate. These characteristics are common to most Asian countries, and hence, it globalization has made fisheries protection and enforcement twice difficult for the poorer Asian countries.

One standard assumption is that poor countries have weaker property rights than rich countries (Chichilnisky 1994; Copeland and Taylor 2004). Cross-country survey data on rule of law and protection of contracts will show that two otherwise identical countries can differ in their property rights regime: one had perfect protection and other none whatsoever. This exogenous property rights differences can lead to comparative advantage in fishing and losses from trade for a poor country. Hence, by opening up to trade and exports poorer countries have been experiencing an increased depletion of their fish resources, and may also experience a decline in steady state real income. This is because the trade-induced increase of fish price and demand have attracted additional investment and effort into fishery and exacerbated the open-access externalities. In other words, increased harvest and higher price though raised consumption possibilities in the short-run, but it is leading to depletion of fish stocks in the long run. This means future generations who will inherit the now lower fish stock will achieve lower expected lifetime utility or benefit than they would have in the absence of trade liberalization (Copeland and Taylor 2004).

On the other hand, trade liberalization can lead to emergence of an effective management regime. This is because the increased price of harvest arising from trade liberalization in a fish-exporting country will act as an incentive to enforce harvest restrictions. At higher prices a degree of protection is afforded to the resource, and with limited management in place, the resource generates rent. This in turn can raise the welfare in both short and long run. Hence, where management is limited or perfect trade liberalization is welfare improving. Of the specific significance is the role of well-meaning governments doing the best they can in difficult situation brought about by a combination of slow resource growth rates, productive harvesting technologies and large populations with relatively short life-span. It high lights the often ignored and positive role international trade may play in raising the value of fish stocks, and thereby strengthening a country's incentive for management (Ostorm 1990).

In conclusion, if property rights are fully assigned and perfectly enforced, then there are no market failures, and so the usual gains from trade will accrue. On the other hand, if property rights are completely absent, then trade liberalization can be devastating. There is, however, considerable evidence showing that enforcement of property rights varies across countries, over time and by fishery type. Hence, changes in world prices and other effects of globalization may alter de facto property rights regime and lead to impacts quite different from those predicted by analyses that assume fixed property rights, such as open access and lack of enforcement.

Solutions - Going Beyond Fish Resource Management

By taking account of the major shifts that are taking place in the fish sector and combining forward-looking policies with investment in useful new institutions, property rights and incentives, policymakers can help ensure that the fish sector becomes remains environmentally sustainable as well as beneficial for the world's poor people (Delgado et al. 2003). The key questions in front of Asian fishing nations are the following: a) are there Asian models for managing capacity and conflicts in fisheries that will ensure sustainable fisheries management; b) how will aquaculture interact with capture fisheries and wild fish stocks; c) how to avoid and reverse ecological collapse in Asian fisheries. The answers to these questions lie in the pursuance of a broad range of strategies that would look beyond the narrow perspective of fisheries production and management which include the following:

Harnessing multi-level benefits from fish sector. Only by harnessing the multi-level benefits from fish sector one can ensure the policy attention the sector deserves. It is important to recognize the multi-level benefits and links that fisheries provide in the national economies of poorer Asian countries, such as contributions to macroeconomic growth through trade and domestic resource mobilization, and support to micro-level income and livelihoods by which the poor can benefit directly. LIFDCs or NFIDCs (net food importing developing countries) that are also significant fish producers have seen the large share of their foreign exchange coming from fish exports, which definitely helped in their balance of payments deficits, and paid for the high food imports. At the more micro-level, fishing, fish farming and post-harvest activities are key income sources, and buffer against food insecurity at times of shortage. Only recently, with the completion of the joint World-Fish and IFPRI study the role of fish in food and nutritional security have become a discussion topic, and has fish been integral part of the global model for food projections (Delgado et al. 2003).

Coherence and comprehensiveness of policies. There is no substitute to a coherent policy that allows poorer countries as well as poor people to stay competitive in the global market. An area of analysis should be the coherence of government policies in supporting the fight against poverty. For instance, policies aimed at eco-labelling of fisheries (and the introduction of sustainable fisheries management through market forces) may have adverse effects on the equity of benefits derived from those fisheries unless policies are developed in mutually reinforcing ways. Governments in Asian developing countries must channel the benefits back to the poor people who contributed to these exports by prioritizing investment in human and economic capital building in the coastal communities and providing stewardship to coastal communities over the fisheries resources. There are many examples where trade-dependent growth or technology and credit support to the poor could not be sustained, and it had worked against the interest of the poor. It made many poorer economies prone to risk or pushed the poor people off their traditional livelihoods. Countries often find it difficult to absorb shocks due to sudden change in foreign demand for domestic exports. To guard against these risks national trade and macroeconomic policies need to work hand in hand with micro-level social and economic safety-nets as well as investment in resource management activities.

Fish as an entry point for integrated coastal community development

Fish makes a good example of integrated coastal community development. The fish sector provides an entry point for diverse options and opportunities for rural poverty elimination through creation of livelihoods, income and jobs, including employment of women. Artisanal fishers are routinely amongst the poorest of the poor. By linking fisheries management and aquaculture development to rural development one can reduce the vulnerability of specific groups of the poor in a community dependent on fish for their livelihoods, and can provide additional means to escape poverty and hunger. Options for sustainable resource exploitation should be promoted through support for research and innovation within the context of rural development.

Good Governance - a key factor

There is an urgent need for improving governance at all levels. Increasingly, lack of good governance – transparency, accountability, responsibility and participation –that empowers poor people rather than strengthening those in power is recognized as hindrance to good resource management and development outcomes. Poor governance is the main cause of overfishing and illegal, unreported, and unregulated (IUU) fishing, and a source of conflicts, hindering progress in fisheries management. in most parts of developing world A lack of good governance has created social, cultural, ethnic and religious rifts within nation states over resource rights, fishing rights, access and distribution. National, international and civil society efforts to eliminate poverty and hunger should make a more forceful statement in promoting good governance and participation for fisheries management. Again, fisheries governance can only improve if there will be an improvement of the overall governance.

Building goodwill and global constituency

Finally, there is a need to build a better sense of goodwill and a stronger global constituency on poverty and environmental issues. To implement necessary reforms in areas of market access, trade barriers and tariffs would require significant goodwill on the part of the richer nations. Many of those reforms can only come when there is a greater awareness and appreciation within civil society in the advanced countries of its roles and responsibilities in the war against hunger and poverty, and in ensuring sustainability of the environment. Otherwise, governments in the advanced countries will have difficulty in harmonizing domestic policies, such as perverse support and subsidies for domestic agriculture and industrial products, with those that affect international trade with developing countries without risking adverse public opinion. Politicians, international organizations and civil society groups should promote greater public support in both developed and developing countries for the cause of the poor, fisheries and the environment. This is recognizing the fact that productivity and efficiency gains, and management improvements at local levels alone will not solve the problems of the poor. Trade and market policies and bilateral and multi-lateral arrangements on fishing access and licensing pursued by national and foreign governments are also keys.

To summarize

Policy changes are fundamental to ensuring the sustainability of Asian fisheries in the era of globalization. The issues poverty and livelihoods of poor people can't be separated from fisheries management in most Asian countries as majority of them have an excessive number of people are dependent on fisheries for their livelihoods. We cannot avoid not discussing the fundamental issues of access, rights, and participation when discussing models for good fisheries management. Creation of enforceable property rights, and institutional development and devolution toward co- and community- management that involve primary stakeholders are pre-conditions for improving the health of aquatic environment and ensuring the sustainability in fisheries.

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Restoration and Management of Small Scale Fisheries: Meeting the Challenge

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In February 2003, small-scale fisheries featured as a stand-alone item on the agenda of the FAO Committee on Fisheries (COFI) after a break of some two decades. This has been a welcome "re-recognition" of the importance of small-scale fisheries to food-fish supply, to employment and to the incomes of millions of rural producers. More recently, in his report submitted to the 59th Session of the United Nations General Assembly, New York, 2004, the Special Rapporteur on the Right to Food of the Commission on Human Rights carried a special section on the right to adequate food and fishing livelihoods.

The re-emergence of small-scale fisheries in the international arena has been influenced by the series of world summits since the mid-1990s which have progressively focussed the attention of the international community on the twin and inter-related goals of eradication of poverty and achieving food security for all[1] The 1995 UN World Summit for Social Development expressed the commitment to combating poverty as an ethical, social, political and economic imperative of humankind. The 1996 World Food Summit pledged political will and commitment to achieving food security for all and to reducing the number of undernourished people to half their present level no later than 2015. The UN Millennium Declaration contains the commitment to halve, by the year 2015, the proportion of the world's population whose income is less than one dollar a day and re-affirmed the commitment to halve the proportion of people who suffer from hunger. COFI recognized that the potential of small-scale fisheries to contribute to these goals has not been fully utilized and is not well reflected in current fisheries policies (FAO 2003).

The first part of the paper elaborates on the contribution of small-scale fisheries to economic, social, cultural and nutritional well-being. The second part discusses the vulnerability of the small-scale sector, its dynamism and some other critical characteristics of the sub-sector. The third part of the paper briefly presents the significant global commitments that have emerged supporting sustainable fisheries, improved food security and the reduction of poverty.

The forth and final section is about realizing a vision where:

- *Small-scale fisheries are not marginalised and their contribution to national economies and food security is recognised, valued and enhanced;*
- *Fishers, fish workers and other stakeholder have the ability to participate in decision-making, are empowered to do so, and have increased capability and human capacity; thereby achieving dignity and respect; and*
- *Poverty and food insecurity do not persist; and where the social, economic and ecological systems are managed in an integrated and sustainable manner, thereby reducing conflict. (ACFR, FAO. 2004)*

The challenge for the restoration and management of small-scale fisheries is to create an enabling environment for small-scale fisheries that will promote the realisation of this vision.

The contribution of small-scale fisheries to human well-being, food security and poverty alleviation

The current contribution of small-scale fisheries to human well-being, food security and poverty alleviation is poorly understood. There are a number of reasons for this unfortunate state of affairs. First, the priority of fisheries statistical systems is by tradition to measure catches in quantity and often in great detail by species group or species. The value of the catch, the cost of production, the number of people employed in production and whether the catch has been produced by large-scale or small-scale fisheries are not always systematically collected in fisheries statistical systems. Second, the extent of under-reporting of small-scale fisheries employment and catches is significant, especially of seasonal and occasional small-scale fisheries in inland waters. For example, in the Tonle Sap Lake area in the Mekong Basin, hundreds of thousands of households divide their time between fishing on the open waters of the lake and on the adjacent floodplains during the rainy season, and the cultivation of rice paddies and other subsistence and cash crops during the rest of the year (Ahmed et al. 1998). Third, and perhaps most importantly, the direct and indirect contribution of small-scale fisheries at the local (meso) and household (micro) levels to food security, as a coping strategy to reduce vulnerability, and as safety-net to prevent falling into poverty, are poorly understood, sometimes simply as a result of poor communication of these benefits to policy-makers.

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[1] In FAO, the issue of poverty and fisheries was first considered as a distinct research topic on the occasion of the Third Session of the Advisory Committee on Fisheries Research, Rome, 5 8 December 2000, based on a paper by the FAO Secretariat (Willmann 2004).

Globally, according to statistics reported to the FAO, there are about 39 million fishers and fish farmers of whom at last ninety percent, or 35 million, are engaged in small-scale fisheries and aquaculture. A few studies have suggested that the ratio between primary employment and secondary employment in fisheries-associated occupations, particularly marketing and processing, are in the order of 1 to 3. This would indicate a figure of about 105 million people employed in such secondary occupations and thus a total employment of about 140 million. Adding those infants, children and old people that depend on these income-earners, perhaps as many as 250 million people live in households that depend primarily on small-scale fisheries and aquaculture. This is about 4 percent of the world's population. Although a large figure in itself, its significance lies in the extent to which these people belong to the poor and vulnerable sections of the population. Globally, it is estimated that there are 1.1 billion people living on less than US $ 1 per day (World Development Indicators 2004[2]). If many of the fishery-dependent people are poor, they represent a significant share of world poverty. Even if the incidence of poverty among fishery-dependent people was only as high as on average in their respective countries, there would be some 23 million fishery-dependent people living on less that one US $ per day (FAO 2002b).

Let us turn now to the contribution of small-scale fisheries to food security. Nowhere else in the world is the consumption of fish so conspicuous and important in the food basket than in Asia. While globally fish contributes some 15 percent to total animal protein intake, in the developing world this share is nearly one fifth. Fish provides at least 30 percent of animal protein intake to 1 billion people and about 56 percent of the world's population derives at least 20 percent of its animal protein intake from fish (FAO, 2002b). In many Asian countries, the share of fish in animal protein consumption is often above one third, and in some countries even above one half, and can reach 90% in isolated parts of coastal, island and inland areas. Fish is highly nutritious, supplying indispensable micronutrients generally not found in staple food. It is a very important source of pre-formed Vitamin A and Vitamin D if its oil is ingested. Fish also contains thiamine and riboflavin (Vitamins B1 and B2) and is a source of iron, phosphorus, calcium and other important trace elements. Marine fish is a good source of iodine and fatty fish is high in polyunsaturated fatty acids, especially omega-3 which is now considered important in lowering harmful blood cholesterol levels. The contribution that fish can make to the nutritional status of young children and lactating women is particularly significant (Kurien 2004).

The percentage that small-scale fisheries contributes to food-fish supply, estimated at over 50% of the total, is considerably higher than this sub-sector's share of total catches. The reason is that significant quantities of the catches of industrial fisheries are converted into animal feed, if landed at all and not thrown overboard. An added positive factor is the decentralized nature of the fish supplies through small-scale fisheries because of their geographically spread-out production structure. The distances between the points of landing and the points of final consumption are generally shorter and the distribution costs lower. Fish produced by small-scale fisheries are, therefore, more available and affordable to poorer consumers.

This is not to neglect the increasing integration of small-scale fisheries into global fish trade. In many small-scale fisheries, possibly in most of them, the contribution to revenue and income of export-oriented fisheries such as for shrimps, cuttle fish, squids, tuna, and aquarium fishes, is significant, and is much higher than suggested by the share of these species in total catch. These export-oriented fisheries are not infrequently the driving forces of modernization of the entire sector and create a multitude of new backward and forward linkages with spillover effects into the wider coastal area. While not necessarily amounting to engines of growth in these areas, small-scale fisheries are, and can be, engines of poverty alleviation.

Probably even more important than their contribution to poverty alleviation, is the role of small-scale fisheries in poverty prevention. Experience suggests that the large majority of households involved in fishing and related activities (full-time, seasonal or occasional fishers), do not generate high incomes but, instead, their involvement in fisheries helps them to sustain and diversify their livelihoods and prevents them from falling deeper into deprivation. The literature, which emphasises how important this role is for rural populations, usually refers to mechanisms such as "fisheries as a safety-net" or as a "last resort activity" (Béne, Macfadyen, Allison, forthcoming).

Although these poverty prevention mechanisms are perhaps less attractive from a purely economic point of view in the sense that no significant surplus rent is generated by the activities- the role of small-scale fisheries as a livelihood support for the rural poor is crucial from a social point of view, especially in remote areas where alternative employment may be scarce and social security programmes either minimal or non-existent. In these areas fisheries can play a critical role as a 'welfare' (or redistributive) system, which would otherwise have to be provided through other forms of social support by local or central government. Inland fisheries are particularly important in this context. Widely dispersed and easily accessible to poor and/or isolated communities, these fisheries provide an important alternative source of income and food when other livelihoods are insufficient. This safety-net dimension of fisheries is obviously of greater importance and relevance to poor and marginalized households with limited access to land and/or other resources (Béné, Macfadyen & Allison,forthcoming).

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[2] World Bank, see: http://www.worldbank.org/data/wdi2004/

Small-scale fisheries can also provide a critical safety net for vulnerable households (even those who were not previously poor) when they face a sudden decline in their income. This can happen, for example, when the head of a household loses his or her job; or if farm crops fail; or, on a larger scale, when the local or even national economy deteriorates (FAO, forthcoming).

The last point that needs to be highlighted in relation to this safety-net dimension is the issue of 'open access' (or semi-open access) that characterizes small-scale fisheries in developing countries. Bene, MacFayden & Allison (forthcoming) note that from a policy point of view and, in particular, from a poverty prevention point of view, it is important to realize that open-access is the key mechanism which permits the 'safety valve' of the fisheries to function by allowing people to freely engage in the sector. This raises important questions concerning the trade-off that may need to be made if one wishes to maintain the capacity of small-scale fisheries to play their safety-net role (poverty prevention), while at the same time one is trying to restrict (or at least control) access to these resources for sustainability reasons, and to increase their wealth generating and poverty reduction potential.

Indeed, it can be argued that ending open access to small-scale fisheries could contribute to environmental sustainability in the medium to long-term, and thus improve food security conditions of present and future generations. It may do little, however, for poverty prevention in the short-term and this needs to be taken into account in fisheries management policy.

Some critical characteristics of small-scale fisheries

High vulnerability of small-scale fisheries

Fishing households in general, and poor fishers in small-scale fisheries in particular, are prone to very high levels of vulnerability, which are closely related to their fishing activities and the type of livelihoods associated with this activity. This vulnerability affects them through various sources of risk such as: high occupational risk (from accidents); high exposure to natural disasters (e.g. floods, hurricanes); high exposure to changes in macro-economic factors (e.g. fuel and other input prices, fish prices); increasingly high exposure to conflicts with other users (due to increased competition for resources) such as industrial fishing fleets and other coastal-zone land and sea users; and most recently to HIV/AIDS. With fishing activities being strongly gendered and women often being found in lower-margin trading activities with low barriers to entry and consequent high levels of competition, women can be especially vulnerable in fishing communities (FAO, forthcoming).

Equally important is that fishing is by nature an unpredictable activity: although there undoubtedly exists a 'loose' relationship between capital investment and returns on that investment, this relationship is particularly uncertain and variable in small-scale marine and inland capture fisheries both in the short and longer terms. It is important to note that the uncertainty affecting capture activities is also transferred perhaps to a lesser extent- to fisheries-related activities (processing, trading), thus affecting other members of the same community and sometimes of the same households. For all these reasons, it is recognised that fishing-related communities are probably amongst the most vulnerable socio-economic working groups (Béné, Macfadyen & Allison, forthcoming).

The dynamism of small-scale fisheries

Notwithstanding the often precarious and vulnerable conditions of small-scale fishing communities, this sector demonstrates a remarkable dynamism, adaptability and resilience to various adversaries including the increasing competition from industrial fisheries. In many small-scale fisheries technological progress has been of an astonishing speed and magnitude, shifting within a matter of years from unmotorized rowing and sailing craft to high-powered modern boat designs utilising a multiple of the previous quantity of fishing gear. Fish-finders and navigation equipment, including GPS, have become common features in a number of small-scale fisheries. As a consequence, fishing capacity and fishing effort have increased dramatically in many fisheries.

The progress has not been uniform throughout the sector, however, and the spread between the smallest and the largest fishing units has greatly increased, as has the gap in catches and incomes between fishers.

Onshore developments have been no less spectacular: there is much more use of ice and of modern fish-carrying equipment; there are many more motorized small-scale fish collectors and distributors, and there are many more small fish markets with basic handling and preservation facilities. Much more fish produced by small-scale fisheries is now entering export-processing and global trading networks.

Dynamics of overfishing

It is a tragedy that the great entrepreneurial dynamism of small-scale fisheries has not been properly rewarded because of the lack of policy reform and as a result of stagnant institutional arrangements for fisheries management. The efforts of governments to create an enabling environment for the sustainable use of the inland and marine aquatic resources have been in no way commensurate with the inventiveness and ingenuity of the small-scale fishers and the fishing industry. The mismatch between the introduction of effective regulatory frameworks and the growing harvesting capacity of both the large-scale and small-scale fisheries has had dire consequences in terms of reduced stock sizes, often of the most valuable species, ecosystemic shifts in species composition and, not least, large-scale economic waste and social hardship.

The numbers of small-scale fishers has often increased at the same rate or, in some instances, at an even greater rate, than overall population growth in many Asian countries. However, it is not "Malthusian overfishing" that is at the core of the overfishing problem we are witnessing, as it happens both in economies with growing and with declining populations. The reason is that the increase in harvesting capacity and effort resulting simply from population growth is small in comparison to the increase resulting from growth in capital inputs and technological progress. Various studies have shown that the long-term rate of technological progress in marine fisheries results in an increase in effort in the order of 2 percent p.a., that is considerably higher than the current population growth rate in Asia. Even more pronounced has been the growth in the physical capital stock per fisher in terms of the amount of fishing gear, horsepower and increasingly electronic equipment.

On the nature of open access

The dynamics of overfishing in small-scale fisheries are often poorly, and sometimes misleadingly, described. While the root cause is rightly attributed to the condition of "open access", this condition is often erroneously explained and understood[3]. Open access is generally associated with the free and unimpeded entry into fisheries by people who take up fishing in the expectation of higher earnings than their current earnings in other occupations, or, more typically, by people who have become displaced elsewhere in the economy[4]. This latter dynamic underlies the concept of fishing as an activity of last resort.

Ending open access, in the sense of limiting access to additional labour, is a necessary, but not a sufficient, condition for ending overfishing. The key problem is to end the free flow into the fisheries sector of additional capital investments and the intensification of fishing operations, primarily and predominantly by fishing households with a long tradition in fishing. This points to the need to further elaborate on the concept of "open access" by specifically acknowledging the primacy of ending "open access" for capital. The importance of further elaborating on this is underpinned by the prevalent, relevant and intricate flow of capital investments into fisheries and the role of such investments in the intensification of fishing operations.

The dynamics of overfishing have been properly described as "the race to fish". What is not always adequately appreciated are the tremendous incentives and competitive pressures on fishers to upgrade their fishing equipment, increase the horse-power of their engines, carry more fishing gear and move to less selective fishing methods. The rules in this race are unforgiving. A delay in upgrading and keeping apace with one's fellow fishermen may lead to economic ruin. So do excessively high investments with borrowed capital. The extent of indebtedness is staggering in many small-scale fisheries and are no less unsustainable as the current intensity of fishing.

Competition with industrial fisheries

A description of the dynamics of overfishing in small-scale fisheries would be very incomplete without referring to the concurrent developments that have taken place in industrial fisheries. Industrial fisheries development got a head-start in Asia some two, three or even four decades ago when countries adopted policies to actively support technology development and the introduction of industrial fishing vessels. Favourable credit schemes often more favourable than they appeared to be from their formal credit terms because of widespread defaults on interest and principal payments targeted predominantly, if not exclusively, investments into larger-scale fishing vessels, especially trawlers, purse-seiners and modern designs of gillnetters. In some instances the objective of such support schemes may have been to allow the upgrading of small-scale fishers to industrial fishers that can exploit a wider range of resources including deepwater stocks. However, in most cases these schemes benefited the entry into the fisheries sector of a new class of investors of varied backgrounds, but rarely from fishing communities. In the very early phases of these developments, catch rates and returns on investment were frequently high, fuelling further expansions in fleet sizes. A classical example, often referred to, is the development of the Thai fisheries in the Gulf of Thailand. In a matter of less than one and a half decades from the time the first trawlers were introduced, the fishery was considered to have become over-capitalized. Since then, the fleet size has more than doubled!

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[3] In the international debate, overcapitalization and overfishing are increasingly solely associated with subsidization. While there can be little doubt that fisheries subsidies have often contributed to overinvestment, it would be grossly erroneous to expect that a cessation of subsidization would resolve the key constraint on sustainable fisheries, that is to put in place effective fisheries management through, inter alia, the establishment of use rights.

[4] There is evidence of both dynamics at work in some fisheries, for example: the entry of private small-scale fishers into China's marine fisheries after the removal of restrictions on private enterprises and labour mobility; the move of displaced landless labourers and dispossessed farmers into fisheries in the Philippines or, historically in Andhra Pradesh, India).

The support to the industrialization of marine fisheries encompassed not just fleet development but also ancillary harbour and fish handling infrastructure. A large percentage of fisheries development loans by the Asian Development Bank and the World Bank have gone into large-scale harbour projects. These support schemes have been all but abandoned in most Asian fisheries but in some cases the provision of tax-exempted fuel continues for these types of fisheries.

Today, industrial fisheries are in a crisis of such enormous magnitude that may take several decades to resolve. The manifestations of the crisis are widespread overfishing, universal interference and conflicts with the fishing operations of small-scale fishers, rampant over-capitalization and economic waste. One should hasten to add that, as with small-scale fisheries, the origin of the crisis lies in the race for fish and the absence of effective institutional and regulatory frameworks for fisheries management.

Global commitments for sustainable fisheries

The last ten years in particular have seen significant worldwide changes in the orientation of fisheries policy. There is widespread awareness of the severe extent of overfishing, degradation of fish habitat and loss of biodiversity. There is global recognition of the need to effectively address the problem of excessive fleet sizes and fishing effort, to reduce or entirely phase out unselective fishing methods, to minimize and avoid adverse ecosystem impacts, to reduce and limited aquatic pollution, and of the need to better protect and support the livelihoods of small-scale fishers and their families. The sustainable development agenda has become codified in a series of international instruments including the 1992 Rio Principles, Agenda 21 and Convention on Biodiversity; the 1995 Code of Conduct for Responsible Fisheries and related International Plans of Action; the 1995 UN Fish Stocks Agreement, and the 2002 Johannesburg Declaration and the Plan of Implementation of the World Summit on Sustainable Development. In addition to these global commitments, there have been various regional initiatives to translate overarching principles and codes of conduct into operational policy guidelines[5].

At a wider policy-level, the commitment of the international community to the Millennium Development goals has put the reduction of poverty and the assurance of food security on top of the policy agenda of many countries[6]. The need to more directly target poor, vulnerable and food insecure people has arisen because of the realization that economic growth by itself is insufficient to eradicate poverty. Whereas high economic growth rates have massively contributed to reduce the number of people below the poverty lines in countries such as China and India, it has also dramatically increased inequalities, especially between urban and rural areas, and disrupted the social fabric of many societies. Policy-makers are cognizant that a larger share of economic growth needs to take place in the villages and smaller-sized towns in rural areas. Investments in rural infrastructure, public services such as health, education and sanitation, agriculture and agri-business have lagged behind in many countries.

Small-scale fisheries are predominantly rural and often more remote and cut off from mainstream developments than agricultural communities. They are also less well organized than agricultural communities because of their geographic spread on the margins of seas, lakes and rivers. They are "outliers" of development, even in situations where pro-poor policies have had notable success, such as in the Indian State of Kerala (Kurien 1995).

Creating an enabling environment for small-scale fisheries

The creation of an enabling environment for small-scale fisheries is dependent on the development of a policy framework involving, inter alia, national development and poverty reduction policies; integrated management policies for watersheds, river-basins and coastal areas; sectoral policies for health, education and social security; agriculture and rural development policies; and fishery sector and sub-sector policies for inland fisheries, marine fisheries and aquaculture.

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[5] E.g. ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium "Fish for the People"
[6] E.g. Bangladesh, Cambodia, India, Vietnam.

Participating in policy formulation and reform

Fisheries agencies, the fishing industry and fishworkers' organizations, have to be aware of, and attempt to favourably influence, policies outside the fisheries sector that impact directly or indirectly on small-scale fisheries. Important examples are, national policies on decentralization of decision-making powers to local levels that can be supportive of co-management and community-based management schemes. Similarly, many countries are elaborating poverty reduction strategy papers (PRSPs), but fisheries and fishing communities rarely feature in them[7]. Further, countries increasingly move towards integrated policies and management programmes for watersheds, river basins and coastal areas.

Whilst the fisheries sector and its institutions do not always carry the economic and institutional weight needed to guide and coordinate multi-sectoral management processes, they can play an important role in initiating and spearheading them. As no other sector's productivity and well-being are as directly and severely affected by environmental degradation, habitat destruction and resource overexploitation, it is fisheries stakeholders who frequently have to take the initiative for integrated policymaking and planning.

The effective integration of fisheries, in particular small-scale fisheries, into cross-sectoral and national policy frameworks greatly depends on increasing the awareness of policy-makers and the public at large about the benefits and essential contribution of this sector to national and rural well-being. This requires better selected and targeted data and information on the sector and its effective dissemination and communication.

A powerful means of ensuring effective participation of small-scale fishers in policy-making processes is by them acquiring influence through their own democratic and representative organizations. These are emerging in a number of countries at local, provincial and national levels. The decentralization of decision-making power to lower levels of governance at province, district and municipal levels, helps in providing more direct influence to professional organizations in decision-making[8].

Integrated policies can avoid or minimize conflicts over the use of scarce resources and can realize complementarity and synergies in the development process. Human resources development and institutional strengthening are widely held to be the primary requirements for achieving better integration at the level of individual farms and communities, in river basin and coastal area management, and at the level of sectoral and macro-economic policies (FAO 1995, Article 6.9).

Fisheries management that favours small-scale fishers

On social, distributional, cultural and environmental grounds, there are good arguments for favouring small-scale fisheries in the access to fishery resources especially, but not exclusively, in inshore areas (FAO 1995, Article 6.18). Small-scale fisheries generate more income, employment and food for direct human consumption per unit of harvest than do industrial fisheries[9]. Moreover, adverse ecosystem impacts are often lower.

The current distribution of resource access is distorted, to varying extents, in favour of industrial fisheries, which have benefited from past public support and greater access to finance, technology and know-how. A fisheries management policy in favour of small-scale fisheries would seek to remove this distortion. A first step in this direction has already been taken by several countries in Asia (and elsewhere in the world). This is to reserve an inshore zone for exclusive use by small-scale fishing craft and gear. These zones vary considerably in width typically in the range of 2 to 15 km from the shore. There are also great differences in the extent to which these zones are actually enforced and illegal encroachment curtailed. There are various aspects which impinge on enforcement, including manpower and equipment, the level of fines, the extent of corruption, and the capacity of the judicial system. A paramount factor, however, is the extent of overcapacities of industrial vessels where overcapacity is high, vessel operators often cannot make ends meet without access to inshore resources.

This points to the second essential step that is required for the implementation of a pro small-scale fisheries management policy, namely the scaling down of the industrial fishing fleet. The reduction of industrial fishing capacity would meet concurrently two objectives: (i) re-distributing access to fishery resources to small-scale producers thereby directly contributing to poverty reduction, and enhancing food security; and (ii) improving the efficiency, profitability and incomes in the remaining fleet of industrial vessels.

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[7] In a recent global review of 281 national policy papers, among which are 50 poverty reduction strategy paper (PRSPs) and/or interim PRSPs, it was found that in only a small number of countries fishing communities are among the target groups and the fisheries sector is accorded an explicit role in poverty reduction and food security (FAO-SFLP, 2004).

[8] E.g. India, Indonesia, Philippines, Sri Lanka.

[9] There are few studies in fisheries which have analyzed the comparative performance of small-scale and large-scale fisheries. One of the first detailed studies concluded that, on account of a series of indicators, including profitability, value added per unit of capital investment, and energy consumption per unit of fish harvested, small-scale fisheries, on average, performed better than industrial fisheries (Kurien and Willmann 1981). As the study was conducted prior to the motorization of small-scale fisheries, these findings would have to be verified for the current conditions.

The implementation of such a win-win policy faces formidable difficulties. First, the task itself is of an enormous scale in many Asian countries because of the extent of fleet overcapacity. Second, current operators of industrial vessels have often acquired some kind of right of access to fishery resources, however weakly they may be defined. Third, there are large numbers of fishing crews that would be affected by the scaling down of the industrial fishing fleets.

The adjustment of industrial fishing capacity has to take place on a voluntary basis to be politically feasible and in order to follow democratic principles. There are two main approaches that can be pursued in this regard. One approach is to attain fleet adjustment through a market-based mechanism. Such an approach requires the establishment of individual transferable fishing rights determined either in terms of catch quotas or fishing effort quotas. Rights-holders who exit in a fishery will be compensated by the purchasers of these rights. The feasibility of introducing ITQ systems in Asian fisheries has been questioned because of the large number of operators, the multi-species nature of most fisheries and the large number of landing places. For these reasons and the perceived problems of enforcement, many observers have ruled out the applicability of ITQ systems in most of Asia's fisheries.

The second approach for fleet adjustment is through vessel buyback or decommissioning programmes. The experience with vessel buyback programmes in developed country fisheries has not been very positive for a number of reasons. Decommissioning programmes have tended to purchase underutilised vessels, thereby having a smaller than expected impact on harvest in the fishery. Second, a capacity reduction programme may create incentives for re-investment and re-entry into the fishery, thus undermining the objective of the programme. Third, spill-over effects arise if excess capacity in the down-sized fishery is permitted to enter another fully-exploited fishery. Fourth, technological progress tends to cause the re-appearance of excess capacity in the medium and long term as remaining vessels become more efficient.

In principle, these issues can be addressed through careful design of the decommissioning programme. Some key features would often include: a clear relationship between the level of compensation and the extent of past participation in the fishery; incentives for the re-investment of compensation payments into local non-fishing enterprises; the proper disposal, or possible destruction, of the retired vessels to avoid their reuse in other overcapitalized fisheries; the move towards a rights-based management system, more commonly based on effort/capacity quotas than on catch quotas; retirement benefits, re-training and start-up capital for fishing crews; extraction of resource rent from the remaining participants in the fishery to finance the buyback programme and to prevent the re-emergence of overcapacities.

The urgency of addressing overcapacities and overfishing in marine fisheries was recently voiced in a national seminar in Thailand. It was recognized, however, that preconditions for a successful capacity reduction programme were to acquire a complete database and registration of all commercial fishing vessels and the immediate instituting of a complete freeze on the entry of new harvesting capacity. The need for better MCS and the curb of IUU fishing were also highlighted, as was the need for better coordination among the various government agencies with responsibilities for MCS and law enforcement. There was also a call for closer involvement of the fisheries associations in fisheries management under various kinds of co-management arrangements at local, provincial and national levels. Such co-management arrangements were seen as critical to avoid the pitfalls of several unsuccessful efforts during the past one and a half decades to establish a limited licensing scheme for commercial fishing vessels in the country.

In spite of their hitherto poor track record, vessel buyback programmes feature prominently in developed countries fisheries policy and are increasingly considered by development banks as a key element in investment programmes aiming at sustainable fisheries. The specific reference to such programmes is notable, for example, in the recent World Bank fisheries sector approach paper entitled "Saving Fish and Fishers" (World Bank 2004).

The down-sizing of industrial fishing capacity and effort and its confinement to waters further offshore would create, and restore, greater fishing opportunities for small-scale fishers. This would be able to address, at least partly, the problem of current overcapacities in the small-scale sector itself. Whether it suffices to put in balance fishing capacity with the abundance of coastal fishery resources is open to question. Nevertheless, the adjustment measures for the industrial fishery sector would send a strong signal to the small-scale sector that the government is serious about both protecting its interests and seeking to ensure that fisheries are well-managed.

These greater fishing opportunities might well instigate an intensification of fishing effort as well as new investments into to the small-scale fisheries sector that could nullify, in the medium term, all the benefits derived from the buyback programme. Therefore, the institutionalizing of efficient small-scale fisheries and industrial fisheries management regimes has to go hand in hand with any capacity reduction of the industrial fleet. One without the other is counterproductive and any benefits would be dissipated quickly.

Co-management of small-scale fisheries

In spite of considerable research on community-based fisheries management and fisheries co-management, and efforts at practical implementation during recent years, there are no ready templates available on how to do it. While many countries have initiated local-level co-management schemes on a pilot basis, the practical implementation efforts are still relatively few and far between, and the lessons learned from them are indicative rather than prescriptive. Perhaps more important than these pilot projects are the steps taken by an increasing number of countries to introduce legal reforms to decentralize or devolve governance to provincial, district or municipal levels. This is supportive of the principle of subsidiarity[10] but full implementation requires that, with the delegation of powers, financial resources and tax authority also be delegated, and that administrative capacities at lower levels be strengthened through human capacity development.

In a recent article Nielsen et al (2004) provide an overview and synthesis of experiences with co-management in Southeast Asia and Southern Africa. Perhaps not unexpectedly, the concept of "co-management" continues to remain loosely defined with different meanings for different people. Various attributes are used jointly with this term in an attempt to clarify what is meant. Nielsen et al, for example, distinguish between the "instrumental co-management approach" and the "empowering co-management approach". In the former and more widely found approach, the role of fishing communities is reduced to implementation. A mechanism is devised through which fisheries departments seek to engage communities to implement fisheries management locally but with the objectives and measures to be taken determined in a top-down fashion typical of centralized management regimes. This approach has not worked very well as it maintains the core structural problems of centralized management.

The empowering co-management approach[11], on the other hand, seeks to vest power in the co-management authority at the local level. There is a clear commitment by central government to share power and authority with local government, fishers and community organizations, and, establish a clear legal basis for the arrangement. Examples for this co-management approach are coastal fisheries in Japan and Norway.

Since the early 1980s, FAO has promoted the concept of community-based management that would respect traditional and customary fishing rights and management practices[12] and would centre around various kinds of fishing rights (Beddington & Rettig, 1984), primarily Territorial use rights in fisheries TURFs[13] (Christy 1982)[14]. However, progress has been slow. In the 1980s, fisheries development, rather than management, was still the priority of most governments. In the 1990s, the legal situation started to change and the delegation of fishery management authority to local government entities became a distinct possibility. But it is still rare for national legislation to allow for well-defined fishing rights to be held in common by fishing communities or groups of fishers. Perhaps an even greater impediment is the limited capacity of local government to support community-based management regimes. On the other hand, the ability of communities to take the management of "their resources" into their own hands is probably underestimated.

The example of Japanese fishing cooperatives indicates the great diversity and ingenuity of the management arrangements which groups of fishers have designed within the wider framework of the territorial fishing rights held by the cooperatives. There are several hundreds of these arrangements, each designed for the specific fishery and conditions of the participants. Their emergence has not been driven by government extension agents but originate from the assignment of rights themselves and negotiations among the members of the fishing cooperative and/or members of the group. They seek and receive advice from government research institutes on the status of the stock(s) and combine these research findings with their own observations and their own individual needs and requirements to jointly set management objectives and jointly exercise other management functions.

Since Christy proposed the catch quota concept in the early 1970s and the TURF concept in the early 1980s, a broad consensus has been attained on the need to move towards rights-based management (WHAT 2000; FAO/Australia Conference on Property Rights in Fisheries) and countries are reforming their legislation to allow for such rights.

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[10] The subsidiarity principle is intended to ensure that decisions are taken as closely as possible to the citizen and that constant checks are made as to whether action at national level is justified in the light of the possibilities available at lower administrative levels (adapted from http://europa.eu.int/scadplus/leg/en/cig/g4000s.htm). In more generic terms the principle states that problems are best solved in the subsystem where they arise. Subsystems are encouraged to resolve their conflicts themselves without referring them to higher authority. (Wheeler, 1970, p. l33; quoted in http://pespmc1.vub.ac.be/ASC/PRINCI_SUBSI.html).

[11] Jentoft argued that "co-management means that fishermen's organizations not only have a say in the decision-making process, but also have the authority to make and implement regulatory decisions on their own" (Jentof 1989); A recent assessment of 19 case studies in West Africa drew the conclusion that, where this is the case, management is more likely to be effective (Allison and Badjeck, forthcoming)

[12] See, for example, Weigel (1985); Mathew (1991); Ruddle (1994)

[13] It should be noted that TURFs are best suited to stocks that are relatively sedentary or localized in their distribution.

[14] For a more recent review of use rights see A Charles (p131) in Cochrane (2002).

The practical difficulties in the definition, assignment and enforcement of fishing rights are significant and it will take many years for them to be fully resolved[15]. The history of the development of land tenure rights shows their complexity and the time it takes. Fishing rights pose even greater challenges because it is so much more difficult to observe and monitor what is happening in seas, lakes and rivers. Moreover, fishermen associate with the movements of the resources across space more akin to nomads - rather than with a fixed territory as farmers do. The notion of TURFs, therefore, may entail for many fishers a cultural change. On the other hand, as the examples of Japan and Korea demonstrate, territorial rights also lay the ground to turn fishers into farmers farmers of the sea who culture, nurture and enhance fishery resources and who defend the quality of their property vis-à-vis other resource users. Incidentally, while there are several explanations for the rapid growth of cultured and enhanced fresh water fish production in Asia, such as improved extension services, it is likely that the single most important factor has been improved property and/or use rights.

Thailand, to mention just one example, has commenced the process of establishing boundaries of district and community fishing areas. The process is extremely complex because of the varied situations and conditions ranging from open coast to isolated islands and groups of islands. In some areas, the seaward boundaries between provinces are not yet established. From the initial rounds of discussions among stakeholders, it has clearly emerged that there is no unique preference or unique solution, and different provinces, districts and communities will adopt different solutions.

Diversity of approaches will also be the natural feature of how communities will regulate their internal affairs once community TURFs have been established. This will be largely a "learning-by-doing" process where big mistakes may be prevented by good advice and support from government and civil society groups. It is unfeasible, impractical and undesirable for governments to "micro-manage" the process of community-based management. But governments will have to fulfil important functions. They must take ultimate responsibility for the protection of the assigned fishing rights. More specifically, they will have to with the help of the communities enforce the TURF boundaries, especially the seaward boundary. Governments will also need to arbitrate conflicts between different rights-holders. Governments should respond to demands by rights-holders for scientifically based information on the status of stocks and habitats and other pertinent data. In essence, the role of governments would be one of rights-protector and service-provider rather than one of regulator.

The notion of rights-based management is often opposed on the grounds of excluding others from access to the resources, including poor people without alternatives. Exclusion is hereby often presumed to be a complete denial of participation for the excluded in the harvesting of the resources. This perception in many cases is mistaken as evidenced by the observation that in traditional management regimes people in need have often been accommodated to provide temporary support and relief. Further, access is often provided through barter or some other suitable exchange mechanism, including the provision of landing fees to church, mosque or other community funds. Systems of reciprocal access may also be provided to other rights-holders on a permanent or seasonal basis. Communities will establish, over time, more or less complex systems to optimize the benefits they derive from their use rights, whether they do so through their own direct use of the resources, by sharing it with others for a fee or other benefit, or through reciprocal access to other communities' fishing rights.

Applying the ecosystem approach to small-scale fisheries management

There is the view among some observers that international fisheries instruments concluded during recent decades at the global level have been driven primarily by the interests, conditions and problems of developed countries' fisheries. For that reason, these instruments are considered to be impractical and not adapted to the specific conditions of developing countries fisheries, especially tropical small-scale fisheries. A case in point is the emphasis of traditional western management approaches on single stock management as enshrined in target measures such as maximum sustainable yield. There are also misgivings about the strong influence of conservation-oriented environmental groups on developed countries policies with, at times, dire impacts on fish trade opportunities by developing countries and on the immediate livelihoods of their fishers and fishing families (Cochrane, forthcoming).

It should be emphasized that the limitations of single stock "target resource-orientated management" (TROM) have been recognized also in developed countries whose fisheries are sometimes wrongly perceived of being generally of a single-stock-nature. The ecosystem approach to fisheries management (EAF) seeks to overcome these limitations. In general terms, the purpose of EAF

> *"...is to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems."*

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[15] A good overview of the issues is provided in the papers prepared for and the report of the FAO/Japan expert consultation on the development of community-based coastal fishery management systems for Asia and the Pacific held in Kobe, Japan, in 1993.

> *EAF "...strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries[16]".*

EAF is believed to be not just more appropriate to temperate water fisheries but also more suited and widely applicable to small-scale fisheries in both developed and developing countries. As the overarching goal is to implement sustainable development, the shift to EAF entails the recognition of the wider economic, social and cultural benefits that can be derived from fisheries resources and the ecosystems in which they occur. EAF emphasizes the identification and economic valuation of the various direct and indirect uses of these resources and ecosystems. This is better adapted to the multi-specificity of small-scale fisheries and the multi-sectoral basis of small-scale fishers' livelihoods. Further, small-scale fishers have by tradition an ecosystemic view of the sea and its resources. A multitude of fishing gear is adapted to target different species as and when they become available in different seasons and fishing grounds.

EAF stresses the importance of traditional knowledge in the assessment of resources and ecosystems and has a geographically-oriented management focus. It emphasizes participatory and incentive-based management systems as alternatives to command and control regimes(FAO 1995, Article 6.16). Further, EAF recognizes and promotes integrated planning and management and calls for the optimal use of the entire range of environmental goods and services provided by fisheries resources and the ecosystems in which they occur.

EAF-type of management is at the core of traditional management systems that did not focus narrowly on one particular fish stock but recognized the ecosystem as an integral whole. This is reflected in the general positive attitude of fishers to various types of fish sanctuaries and protected (but used) areas for low impact selective fishing gear. Fish sanctuaries have had notable success in the Philippines to mobilize communities around common resource protection and enhancement interests and, in a number of instances, have had significant positive impacts on the restoration of local fish stocks and ecosystems.

Pro-poor small-scale fisheries management

Fishing communities are not homogenous and some fishing households are poorer than others. Therefore, some special arrangements may be desirable in support of poor fishers such as establishing preferential access rights to some areas for specific fishing gears (e.g. hook and line, basket traps, etc.) that are predominantly used by them. This can ensure that poor (or occasional fishers) who can not afford expensive and usually more efficient- fishing gear can still access the resource and rely on it as a poverty prevention activity (FAO, forthcoming).

Where infrastructure and labour are available, encouraging small-scale, labour-intensive local (decentralized) fish processing is a very powerful way to increase the economic contribution of the small-scale fisheries sector to the local economy. Recent studies have revealed that the net additional income from fish sales -if retained in the local area- can be over 100%. In other words if fish can be produced and processed locally, the net income benefit to the area may be more than twice the value of the fish sales (Delgado et al. 2003). Significantly, as it is mostly women who are engaged in such fish processing, the entire income tends to benefits the family, and especially the children[17].

Many fisherfolk live in conditions of poverty because they do not have legally recognised tenure to the land on which they settle. With insecure tenure, fishing communities are often found in 'unofficial' settlements that lack access to basic state-provided infrastructure (schools, clinics, water drainage and sanitation etc) and have no incentive to invest in improving their housing conditions. The absence or insecurity of property rights to the land on which they reside results in a vicious circle where state agencies refuse to provide infrastructure because of insecure ownership. Coastal zone planning that legally designates zones for fishing households to settle, and protects traditional landing sites from alternative development will favour the marginalised and poor, and will improve living conditions in fishing settlements (FAO, forthcoming).

Financing the transition to responsible fisheries

In a recent international review (Schrank, Arnason, Hannesson 2003) the budgetary allocations for fisheries management were estimated to range widely from just above one percent of the ex-vessel value of fish harvested to above one third of their ex-vessel value. While the review did not suggest a direct relationship between this share and fisheries management performance, the current budgetary allocations for fisheries management are believed to be too low in many countries, especially in developing countries. That greater expenditures for fisheries management can be a worthwhile investment derives from the fact that the resource rent potentials in fisheries can range up to sixty percent of the ex-vessel value of the catch. The ecosystem and biodiversity benefits from improved fisheries management are not yet captured in these resource rent estimates. Currently, resource rents are largely dissipated in most fisheries - or are negative because of subsidization and there is an erosion of long term ecosystem and biodiversity benefits.

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[16] extracted from the FAO Fisheries Glossary: http://www.fao.org/fi/glossary/default.asp

[17] It is well documented that male income-earners spend a significant share of their income on consumer items that do not support the family (ref).

Apart from the general need to increase fisheries management budgets, there is also scope for the re-allocation of budgetary resources from those areas that continue to create incentives for increased fishing capacity and effort. For example, countries continue to provide subsidies for the construction and/or operation of fishing vessels. In addition to increases in annual recurrent fisheries management budgets, there is also the need for one-time large-scale investment finance should governments wish to implement vessel buyback programmes. The resources needed for such programmes could reach the order of magnitude of several hundred million US dollars and may require development bank finance. These large investments are needed to compensate owners who give up their fishing vessel and right of access to fishery resources, and to compensate, retrain and re-employ fishing crew (Willmann, Boonchuwong, Piumsombun. (2003)).

The fishery sector, once placed on a sustainable footing, and where resource rents are realized, can finance, through cost-recovery and resource taxes, the higher costs entailed in effective fisheries management. Sustainable fisheries will benefit not just fishers directly engaged in fish harvesting, but also fish marketers, processors, distributors, retailers and exporters. At each level greater and more valuable catch volumes, due to better management, will generate additional incomes, employment and foreign exchange revenue. Various studies have suggested that the ex-vessel value of fish is just between one half and one fifth of the value of the fish at final consumption.

Larger financial resources are also needed for small-scale fisheries management in a broad sense. In many fisheries, the over-arching objective has to be to diversify sources of income and employment of fishing households away from a pure dependency on the harvesting of fish. Emphasis in credit and micro-finance schemes has to be on diversification, rather than on increased specialization as is the case with many fishery credit schemes that target technological upgrading of fishing craft and gear. There is also a need for a shift in the target beneficiaries of these schemes from male fishers to female fish marketers, processors and distributors whose incomes contribute a greater proportion to household welfare when compared with male incomes[18].

Conclusion

Small-scale fisheries sustain millions of livelihoods and make essential contributions to incomes, employment and food security in rural areas of Asia and elsewhere in the world. These livelihoods and contributions to food security are under threat because of resource over-exploitation, aquatic pollution, degradation of vulnerable fish habitats, and competition from within and without the fisheries sector[19]. A concerted effort and strategy is needed for the restoration and management of small-scale fisheries. The strategy needs to account for the multiplicity and diversity of fisheries livelihoods, lay emphasis on integrated and multi-sectoral assessments, policies and plans, and promote decentralized and participatory approaches that make full use of the traditional knowledge, informal rules and customs, and self-organizing and self-help mechanisms of small-scale fishing communities.

Greater awareness and recognition of small-scale fisheries in policy-making is a pre-condition for the full realization of the potential of this sub-sector to contribute to poverty alleviation and food security. This requires better data and information on this sector and better communication of its benefits, of the comparative advantages vis-à-vis large-scale fisheries, and of the unrealized benefits that could be attained from the better integration of this sector into agriculture and other rural sectors.

The diversified and decentralized structure of small-scale fisheries necessitate decentralized and diversified policies and plans. These can only be designed and implemented in an efficient and effective manner through a decentralized governance structure that legally assigns decision-making power and financial authority to lower levels of government at provincial, district and community levels.

Governments need to mainstream co-management and community-based small-scale fisheries management in their policies and action plans. A broad approach to management should be pursued encompassing the various facets and activities that sustain fishing livelihoods and with full recognition of the sustained benefits for family welfare of greater incomes for women. The transition to responsible fisheries in general, and well-managed small-scale fisheries in particular, requires more financial resources and greater human capacities than are currently available through government. Greater budgetary allocations for fisheries management would then be justified and would generate large returns to the economy by reducing, on a voluntary basis, the wasteful use of scarce capital and energy resources in redundant sizes of fishing fleets, especially unselective bottom trawlers that directly compete for the fishery resources exploited by small-scale fishers.

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[18] Gender targeting of credit schemes is difficult in practice as is illustrated by this story: in a small-scale credit scheme for fisherwomen implemented in the Philippines in the early 1990s, it was reported that a significant number of loans taken by the women have been used to buy fishing implements (mostly fishing gear, but also some boats and engines) which are used by men in fishing activities within the already overexploited inshore reef fisheries.

[19] The Code urges fisheries management to promote production "for present and future generations in the context of food security, poverty alleviation and sustainable development" (FAO 1995, Article 6.2).

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Functional Genomics Study of Marine Viral Pathogens

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Abstract

Two important marine viral pathogens, white spot syndrome virus (WSSV) and Singapore grouper iridovirus (SGIV) are chosen as models for functional genomics study. Technologies applied include bioinformatics, proteomics, DNA microarray, protein microarray, RNA interference, and structural genomics. With the wealth of structural and functional information, novel drugs can be developed to boost the aquaculture that is presently devastated by these viral pathogens.
Keyword: White spot syndrome virus, Singapore grouper iridovirus, functional genomics.

White spot syndrome virus (WSSV) and Singapore grouper iridovirus (SGIV)
White spot syndrome virus (WSSV) is an enveloped, double stranded DNA virus with bacilliform morphology (Fig. 1) (1). This virus has a wide host range among crustaceans and infects all commercially important species of penaeid shrimp. It can cause white spot disease, which is an ecologically and economically devastating viral disease of shrimp. This disease results in up to 100 % mortality within 3-7 days after the onset of infection in shrimp throughout Asia and North and South America.

Iridovirus is an animal virus that infects invertebrates and poikilothermic vertebrates such as fish, insects, amphibians, and reptiles (2). It has been implicated as the causative agent of serious systemic disease among cultured and ornamental fish, as well as wild fish. A major characteristic of iridoviruses is their large icosahedral viral particles (120-300nm) present in the cytoplasm in which the circularly double-stranded DNA is amplified. Singapore grouper iridovirus (SGIV) was successfully isolated in 1998 from Malabar grouper (Epinephelusmalabaricus). It is an enveloped DNA virus.

With the completion of the genome sequences of human, rice, fugu and many other organisms, a new genome era in life sciences has begun to focus on the structures/functions and interactions of the gene products. Many functional genomic approaches have been developed to further accelerate the discovery process. These platform technologies include proteomics, DNA microarrays, protein microarray, RNA interference (RNAi), and structural genomics. We are applying these technologies to study two marine viral pathogens: WSSV and SGIV.

WSSV and SGIV can provide important and interesting models for functional genomics study. Firstly, they are important viral pathogens in the aquaculture industry worldwide. Both of them have relatively small genomes, much smaller than many of the microorganisms selected by other research teams for similar studies. Secondary, many of their presumptive open reading frames (ORFs) do not have any match with known proteins and functions. Thirdly, functional elucidation will provide new insight of the biology of these important viruses, i.e. mechanisms of host-pathogen interaction, the maturation and viral assembly. Most importantly, it will provide a wealth of information for structurally based drug design. Fourthly, cell lines have been developed for the study of viral infection in vitro. This would allow the investigation of the novel viral proteins using RNAi and other knockdown technologies.

Genome analyses of SGIV and WSSV

The complete WSSV genome is about 300 kb (Fig. 2a) (3). 531 putative ORFs have been identified by sequence analysis, among which 181 ORFs are likely to encode functional proteins. Most of the ORFs are unassigned, as they lack homology to known genes. Only 18 ORFs encoded protein show 40-68% identity to known proteins or contain an identifiable functional domain. 133 ORFs encode proteins with no homology to any known proteins or motifs.

Recently, the whole genome sequence of SGIV has been completed in our laboratory by using shotgun approach. It consists of 140,131 bp (Fig. 2b) (4). To date, it is the second largest genome determined in iridovirus. 162 presumptive ORFs have been identified to code for proteins ranging from 41 to 1,268 amino acids on the sense (R) and antisense (L) DNA strands. Computer-assisted analyses of the deduced amino acid sequences revealed 23 that of the ORFs share high identity to functionally characterized iridoviral proteins. They are involved in DNA replication, transcription, metabolism, cell signaling, immune evasion and viral structure. 54 ORFs are homologous to unidentified or unknown proteins of other iridoviral genomes. 42 conserved domains, motifs or signatures have been identified.

Proteomics of WSSV and SGIV

Viral proteins from purified the WSSV and SGIV were separated by 1D-SDS-PAGE. Protein bands were excised and subjected to reduction, alkylation, tryptic digestion, and mass spectrometric analysis by MALDI-TOF or Q-TOF mass spectrometry.

More than 24 WSSV proteins ranging from 5 to 190 kDa were detected after 1D-SDS-PAGE (Fig.3a). Most of these proteins show no homology with other known viral proteins. Totally, 18 genes from WSSV were identified by MALDI-TOF and Q-TOF mass spectrometry. Among these proteins, only three, VP24, VP26, and VP28, have been reported previously.

More than 39 SGIV proteins can be identified by 1D-SDS-PAGE (Fig.3b). 26 proteins, covering 5%-67% of amino acid sequences, are matched with the SGIV ORF database. Among them, six are known viral proteins. Additional twelve proteins are homologous to other iridovirus ORFs with unknown function. The rest of them are gene products with unknown function and no homology.

DNA microarray

DNA microarray technology can be employed to screen for viral genes expressed in virus infected and uninfected organisms. By comparing the complex viral transcriptional profiles, specific transcripts that may be involved in viral pathogenesis could be identified. Virus-specific DNA microarray can be constructed for the study of virus biology. Because the function and expression pattern of many of the WSSV and SGIV genes are still unknown, this analysis might help to characterize unknown ORFs such as non-structural proteins, which are generally immediate early and early genes, whereas structural proteins are often late genes. In addition, this approach can be used as a diagnosis method to detect very low levels of infection. DNA microarray studies on WSSV and SGIV can lead to better understanding the molecular mechanisms in virus-induced mortality, thereby identifying ways of regulating the expression of these regulatory proteins to prevent outbreak.

Protein microarray of WSSV

Protein array is an emerging technology that allows high-throughput screening of protein functions, protein-protein interactions, and drugs. Therefore, our current research focuses on cloning all the ORFs of WSSV and expressing their corresponding proteins to generate WSSV protein array. For this purpose, Gateway cloning technology, which is based on the site-specific recombination properties of bacteriophage lambda, was applied. This technology allows moving DNA sequences into multiple vector systems rapidly for protein expression while maintaining orientation and reading frame. Prokaryotic expression system was used first to generate recombinant proteins (Fig.4). For those proteins, which could not be expressed properly, various eukaryotic expression systems will be tested.

Avi- and His-tags are added to the recombinant WSSV proteins to enhance the efficiency of the surface-coupling step of the protein microarray. Avi-tag technology has been applied to label proteins with biotin in vivo or in vitro. Both streptavidin-coated and nickel-coated slides can be used although the binding of a histidine tag to nickel is relatively weak compared to the biotin-streptavidin system.

Once recombinant WSSV proteins are available, they will be used to develop a protein array for screening anti-viral drugs, analyzing functions of viral proteins, and studying virus-host interaction, which will facilitate development of vaccines.

SiRNA study on SGIV

Silencing gene expression using double stranded RNA (dsRNA) known as RNA interference or RNAi provides a powerful tool for analyzing gene function. Selectively down regulating (or knocking down) the expression of a particular gene allows researchers to determine its function in many cellular functions. This experimental approach will be particularly useful to probe the function of novel gene products derived from genomic sequence analysis. Experiments that use siRNA generated by the expression vector or chemically synthesized siRNAs to knock down some important genes of SGIV are ongoing in our laboratory. RNAi, a recent breakthrough in gene knockdown technology, is expected to accelerate the pace by which host cell pathways crucial to virus replication can be identified.

Structural genomics of WSSV

Structural genomics attempts to determine the structures of representative proteins in terms of protein domain and folding and should provide a better understanding of the physiology of the organism under investigation. It offers a unique opportunity to elucidate the function of presumptive proteins based on the determined structures (5). Besides, this study will also provide the structural information necessary for drug targeting and design.

Viral structure proteins are of major importance to determine the taxonomic position of the virus and for vaccine development. The 3D structures of envelope proteins of WSSV are studying by X-ray crystallography. Six recombinant envelope proteins and one capsid protein VP15 have been expressed in E.coli (Fig. 5). Four of them are soluble. Initial crystallization screening was performed using the Hampton Crystal Screen kit and the hanging-drop vapor-diffusion method at 20 °C.

Twelve WSSV proteins with unknown structure/function were chosen as potential candidates for NMR determination. All these proteins are of no sequence homologue and unknown function. They are relatively small proteins with amino acids less than 100 without transmembrane fragment. We used VP234 as an example. This protein was expressed in E.coli successfully. Heteronuclear single-quantum coherence (HSQC) analysis indicated this protein is well folded. By using both 15N-single and 15N/13C double-labeled samples, NMR experiments including 15N-edited experiments, three-resonance experiments for backbone, side chain assignments and NOESY-based experiments for obtaining distance constraints were performed. The derived distance and dihedral angle constraints were used to generate three-dimensional structure by CYANA (Fig. 6). The 3D structure of this novel protein is studying by X-ray crystallography as well.

Summary

Generally, functional genomics will facilitate to determine which of the myriad of host cell gene products are essential for virus survival or for virally induced disease progression. Such gene products represent potential targets for inhibiting virus infection and pathogenesis. Modern virology and antiviral drug discovery are expected to be impacted dramatically by functional genomics study.

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Figure Legends

Fig. 1 • Electron micrograph of purified WSSV virons. The envelope structure is indicated.

Fig. 2 • Genomes of WSSV and SGIV.

Fig. 3 • WSSV viron proteins (a) and SGIV viron proteins (b) separated by 1D-SDS-PAGE.

Fig. 4 • Expression of WSSV proteins in E. coli using Gateway cloning technology.

Fig. 5 • (a) Envelope proteins expression in E. coli. Lane 1: supernatant of cell lysates. Lane 2: pellet of cell lysates. (b) Expression of capsid protein VP15 in E.coli. Lane 1: uninduced GST-VP15; lane 2: induced GST-VP15; lane 2: cleaved VP15.

Fig. 6 • NMR model of VP234.

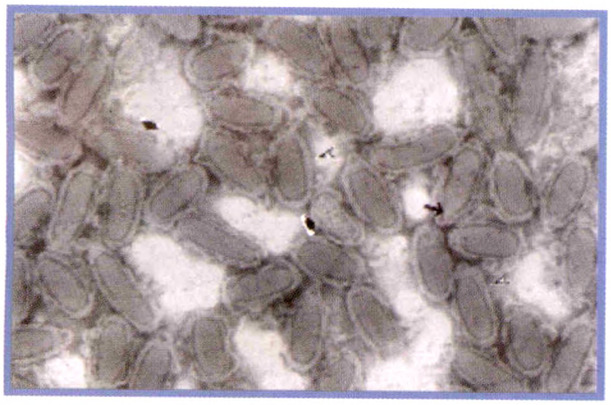


Fig. 1

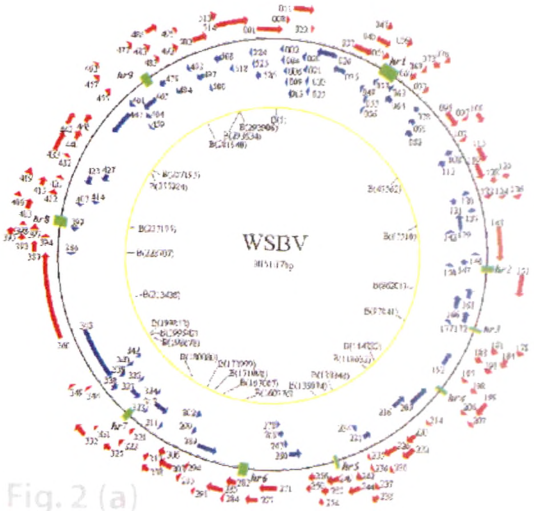


Fig. 2 (a)

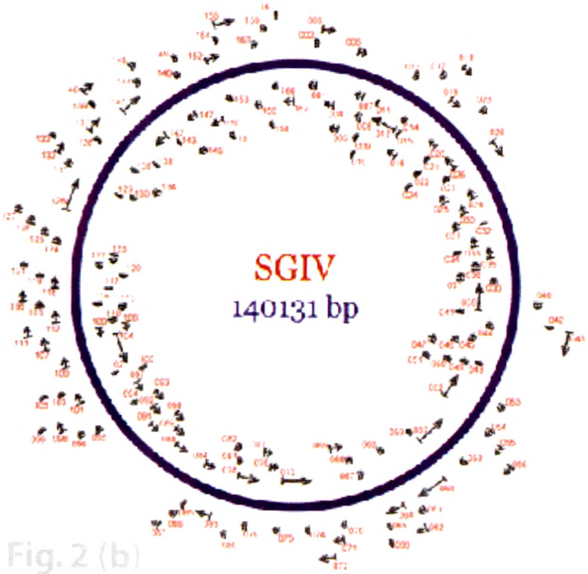


Fig. 2 (b)

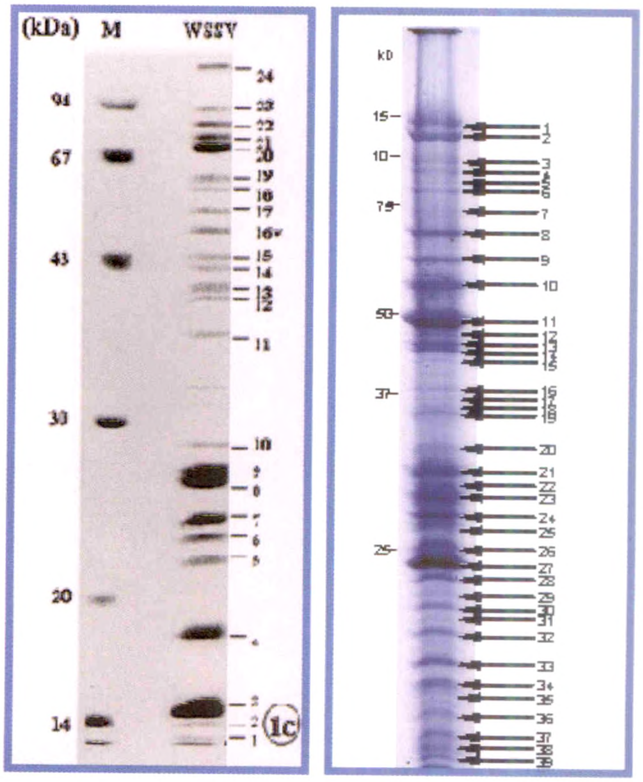


Fig. 3 (a) (b)

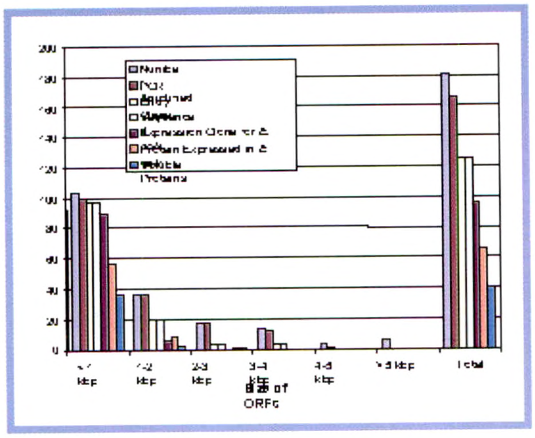


Fig. 4

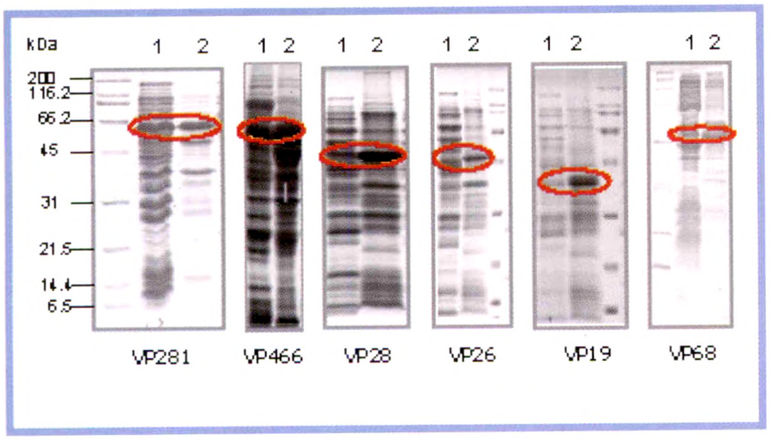
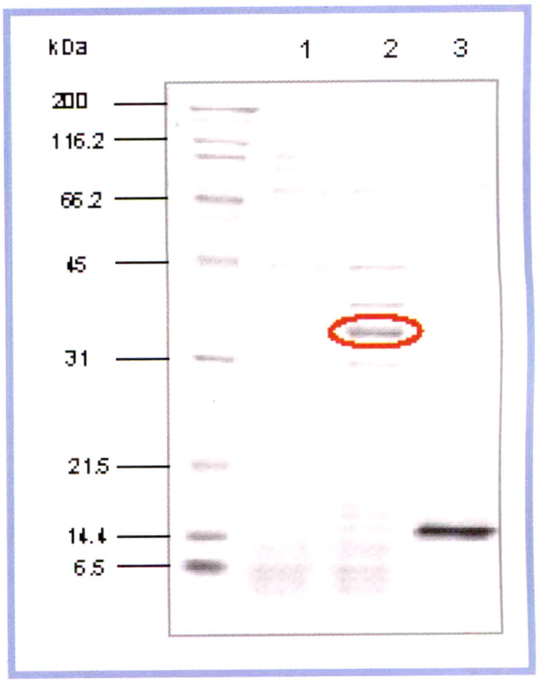


Fig. 5 (a)



(b)

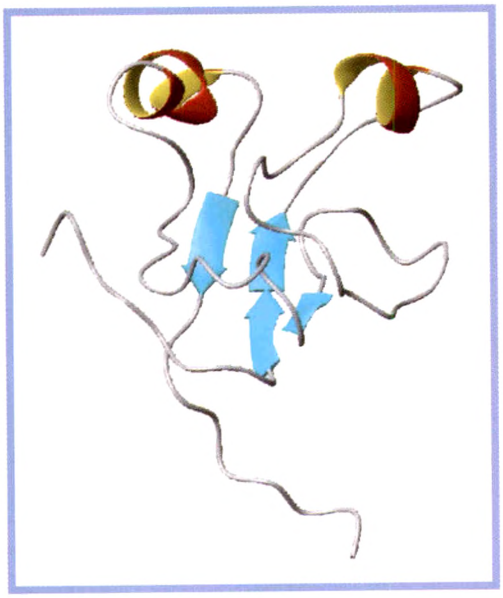


Fig. 6

Forum Programme

Overall Forum Schedule

Overview of Forum

Scientific Programme

Overall Forum Schedule

Monday, November 29

Forum and Exhibition Registration	12.00pm - 10.00pm
Exhibition Set-up	2.00pm - 10.00pm
Poster Set-up	5.00pm - 10.00pm
Welcome Reception (Poolside)	5.30pm - 7.00pm

Tuesday, November 30

Registration	8.00am - 6.00pm
Poster Set-up	8.00am - 9.00am
Opening Ceremony	9.00am - 10.00am
Tea Break	10.00am - 10.30am
Trade Exhibition (invitation only)	10.15am - 11.15am
Keynote Address 1	10.30am - 11.30am
Lunch & Poster Viewing	11.30am - 2.00pm
Trade Exhibition (open to public)	2.00pm - 6.00pm
Concurrent Scientific Sessions (with tea break)	2.00pm - 6.00pm

Wednesday, December 1

Registration	8.00am - 6.00pm
Keynote Address 2	8.30am - 9.30am
Trade Exhibition (open to public)	9.00am - 6.00pm
Tea Break	9.30am - 10.00am
Scientific Sessions	10.00am - 1.00pm
Lunch & Poster Viewing	1.00pm - 2.30pm
Scientific Sessions (with tea break)	2.30pm - 6.00pm
Asian Fisheries Society General Assembly (Matahari Ballroom)	6.00pm

Thursday, December 2

Keynote Address 3	8.30am - 9.30am
Trade Exhibition (open to public)	9.00am - 6.00pm
Tea Break	9.30am - 10.00am
Scientific Sessions	10.00am - 1.00pm
Lunch & Poster Viewing	1.00pm - 2.30pm
Scientific Sessions (with tea break)	2.30pm - 6.00pm
Forum Dinner (Matahari Ballroom)	8.30pm

Friday, December 3

Keynote Address 4	8.30am - 9.30am
Trade Exhibition (open to public)	9.00am - 6.00pm
Tea Break	9.30am - 10.00am
Scientific Sessions	10.00am - 12.00pm
Lunch & Poster Viewing	12.00pm - 2.30pm
Scientific Sessions (with tea break)	2.30pm - 6.00pm

Grand Ballroom 1

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 1.50			1.50 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30
	Registration	Opening Ceremony	Tea	Keynote 1 Dr. Meryl Williams	Lunch				Advances in Shrimp Biotechnology II Overview and new technologies					Tea				

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 2 Dr. M. Ahmed	Tea	Shrimp Genetics						Viral Pathogens			Lunch					Tea				

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 3 Dr. Rolf Wimann	Tea										Lunch					Tea		Phylogeny &		

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote4 Dr. Hew C.L	Tea	Epidem		Bacteria In Shrimp Aquaculture							Lunch					Tea				

Grand Ballroom 2

	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30- 2.00			1.50 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30	5.40 - 6.00
30-Nov	Registration	Opening Ceremony	Tea	Keynote 1	Lunch				**Promoting Environment- Friendly Aquaculture** 🟩 Environmental Management	🟩	🟩	🟩	🟩	Tea	🟩	🟩	🟩	🟩	🟩

	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
1-Dec		Keynote 2	Tea	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	Lunch	🟩	🟩	🟩	🟩	Tea	🟩	🟩	🟩		

	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40- 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40- 6.00
2-Dec		Keynote3	Tea	**Understanding Aquatic Resources** 🟪 Fish & Invertebrate Biology	🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪	Lunch	🟪	🟪 Conservation of	🟪	🟪	Tea	🟪 Biodiversity	🟪	🟪	🟪	🟪

	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
3-Dec		Keynote4	Tea	🟪	🟪	🟪 Effects and Mitigation of Pollution	🟪	🟪	🟪 Critical Habitat				Lunch	🟪	🟪	🟪	🟪	Tea	🟪	Invasive species			

Grand Ballroom 3

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 2.00		1.50 2.00	- 2.20	2.00 - 2.40	2.20 - 3.00	2.40 - 3.20	3.00 - 3.40	3.20 - 4.10	3.40 - 4.30	4.10 - 4.50	4.30 - 5.10	4.50 - 5.30	5.10 -
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch			**Increasing Aquaculture Productivity** ■ Nutrition & Feed Management	■	■	■	■	■	Tea	■	■	■	■

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 2	Tea	■	■	■	■	■	■	■	■	■	Lunch	■	■	■	■	Tea	■	■	■	■

2-Dec	8.00	8.30 - 9.30	9.30 - 10.0010.20	10.00 - 10.40	10.20 - 11.00	10.40 - 11.20	11.00 - 11.40	11.20 - 12.00	11.40 - 12.20	12.00 - 12.40	12.20 - 1.00	12.40 - 2.30	1.00 - 2.50	2.30 - 3.10	2.50 - 3.30	3.10 - 3.50	3.30 - 4.20	3.50 - 4.40	4.20 - 5.00	4.40 - 5.20	5.00 - 5.40	5.20 -
		Keynote 3	Tea	■	■	■	■	■	■	■	■	■	Lunch	■	■	■	■	Tea	🟦 Breeding & Larviculture	🟦	🟦	🟦

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 4	Tea	🟦	🟦	🟦	🟦	🟦	🟦				Lunch	🟦	🟦	🟦	🟦	Tea	🟦	🟦	🟦	

Serindit

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 2.00			1.50 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30	5.30- 5.50
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch				Increasing Aquaculture Productivity Reproductive Physiology					Tea					

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 2	Tea	Genetics & Biotechnology									Lunch					Tea					

2-De c	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 3	Tea	Grow-out Technology									Lunch					Tea					

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	124 0 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 4	Tea	Enhancing the Ornamental Fish Industry									Lunch	Special Symposia Pond Live				Tea					

Tekukur

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 1.50			1.50 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30	5.30 - 5.50
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch				Value Added Products Nutritional Quality					Tea	Post-harvest Technology				

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 2	Tea	Quality & Safety Standard									Lunch	Promoting Environment-Friendly Aquaculture Reducing Risks				Tea	of Diseases				

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 3	Tea	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	Lunch	🟩	🟩	🟩	🟩	Tea	🟩	🟩	🟩	🟩	

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 4	Tea	🟩	🟩	🟩	🟩						Lunch					Tea					

Bayan

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 1.40			1.40 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30	5.30 - 5.50
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch			Special Symposia Technology Needs & Prospects for Asian						Tea	Aquaculture				

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 2	Tea	▨									Lunch	Mariculture in the Asia-				Tea	Pacific Region				

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 4.00	4.00 - 4.30	4.30 - 4.40	4.40 - 5.00	5.00 - 5.30	5.20 - 5.40	5.40 - 6.00
		Keynote 3	Tea	Advances in Seaweed Cultivation & Utilization in Asia									Lunch	▨				Tea	▨				

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 4	Tea	▨									Lunch	▨				Tea					

Pekaka

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 1.50			1.50 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30	5.30 - 5.50
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch				Restoring & Sustaining Capture Fisheries Management Measures					Tea					

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	
		Keynote 2	Tea										Lunch					Tea	Stock Delineation				

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 3	Tea	Stock Assessment									Lunch					Tea					

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 4	Tea	Habitat Restoration									Lunch	Resource Enhancement				Tea				RBC	

Merbah 1

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 2.00		1.50 2.00	- 2.20	2.00 - 2.40	2.20 - 3.00	2.40 - 3.20	3.00 - 3.40	3.20 - 4.10	3.40 - 4.30	4.10 - 4.50	4.30 - 5.10	4.50 - 5.30	5.10 -
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch									Tea				

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 2	Tea	**Special Symposia** Global Symposium on Gender and Fisheries									Lunch					Tea				

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 3	Tea										Lunch					Tea	Discussion			

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 4	Tea										Lunch					Tea				

Merbah 2

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 2.00		2.00	1.50 - 2.20	2.00 - 2.40	2.20 - 3.00	2.40 - 3.20	3.00 - 3.40	3.20 - 4.10	3.40 - 4.30	4.10 - 4.50	4.30 - 5.10	4.50 - 5.30	5.10 -
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch			**Special Symposia** Fisheries Co-Management						Tea				

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 2	Tea										Lunch					Tea				

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 3	Tea										Lunch					Tea				

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote 4	Tea										Lunch					Tea				

Murai 1

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 2.00			1.50 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch				**Special Symposia** Production in Aquatic Peri-Urban in Southeast Asia					Tea				

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40
		Keynote2	Tea	Inland Fisheries									Lunch					Tea				

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.45	10.45 - 11.15	10.45 - 11.00	11.15 - 11.45	11.45 - 12.15	12.15 - 12.45				12.45 - 2.15	2.15 - 2.45	2.45 - 3.15	3.15 - 3.45		3.45 - 4.15	4.15 - 4.45	4.45 - 5.15	5.15 - 5.45
		Keynote 3	Tea	Restocking & Stock Enchancement									Lunch					Tea			

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.30	10.30 - 11.00	11.00 - 11.30	11.30 - 1200						12.00 - 2.30	2.30 - 3.00	3.00 - 3.30	3.30 - 4.00		4.00- 4.30	4.30 - 5.00	5.00 - 5.30	5.30 - 6.00
		Keynote 4	Tea										Lunch					Tea			

Murai 2

30-Nov	8.00	9.00 - 10.00	10.00 - 10.30	10.30 - 11.30	11.30 - 2.00			1.50 - 2.00	2.00 - 2.20	2.20 - 2.40	2.40 - 3.00	3.00 - 3.20	3.20 - 3.40	3.40 - 4.10	4.10 - 4.30	4.30 - 4.50	4.50 - 5.10	5.10 - 5.30	5.30 - 5.50
									Socio-economic Perspectives										
	Registration	Opening Ceremony	Tea	Keynote 1	Lunch				EL	Economic Policies & Institutions				Tea					

1-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote 2	Tea			WIOG							Lunch	Market & Marketing				Tea					

2-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
				Special Symposia																			
		Keynote 3	Tea	Aquatic Ecosystem Health									Lunch					Tea					

3-Dec	8.00	8.30 - 9.30	9.30 - 10.00	10.00 - 10.20	10.20 - 10.40	10.40 - 11.00	11.00 - 11.20	11.20 - 11.40	11.40 - 12.00	12.00 - 12.20	12.20 - 12.40	12.40 - 1.00	1.00 - 2.30	2.30 - 2.50	2.50 - 3.10	3.10 - 3.30	3.30 - 3.50	3.50 - 4.20	4.20 - 4.40	4.40 - 5.00	5.00 - 5.20	5.20 - 5.40	5.40 - 6.00
		Keynote4	Tea	Managing Fishing Impacts on									Lunch	Sharks & Rays				Tea					

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		Grand Ballroom 1 Advances in Shrimp Biotechnology 2 (Overview & New Technologies)		Grand Ballroom 2 Promoting Environment-Friendly Aquaculture (Environmental Management)		Grand Ballroom 3 Increasing Aquaculture Productivity (Nutrition & Feed Management)
0900	**OPENING CEREMONY**					
1000	**TEA BREAK**					
1030	**KEYNOTE 1: DR. MERYL J. WILLIAMS**					
1130	**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)					
1400	**CHAIR** : Paisarn Sithikornkul and Shaun Moss	**BIOTECHNOLOGY IN SHRIMP AQUACULTURE RESEARCH: APPLICATIONS AND EXPERIENCES AT THE OCEANIC INSTITUTE** Shaun M. Moss	**CHAIR** : Fatimah Md. Yusoff and Madhav K. Shrestha	**AN IMPROVED CULTURE ENVIRONMENT WITH A DEVELOPED CLOSE-CYCLE AQUACULTURAL SYSTEM & DESIGN FOR INTENSIVE CULTURE OF TILAPIA** M.A. Zaman*, M.A. Ambak, A. Jusoh	**CHAIR** : Shin-ichi Teshima and Md. Shah Alam	**EFFECT OF Squilla MEAL INCOPRPORATED DIET ON THE GROWTH AND NUTRITIVE VALUE OF *Labeo rohita*** L.M. Rao*, K. Satish Kumar
1420				**INFLUENCE OF CONFINEMENT STRESS AND SEX RATIO ON THE IMMUNE RESPONSES IN *Oreochromis mossambicus*** C. Binu Ramesh, Dieter Steinhagen, R. Dinakaran Michael*		**SOYBEAN MEAL SUPPLEMENTED WITH THREE SELECTED AMINO ACIDS IN DIETS FOR *Mystus nemurus* FINGERLINGS UNDER WATER RECIRCULATING SYSTEM** M. A. Zaman*, C. R. Saad, M. A. Ambak, M. S. Kamarudin, A. R. Alimon, Adam Puteh
1440		**THE APPLICATION OF BIOTECHNOLOGY TO UNDERSTANDING THE EVOLUTION OF VIRULENCE IN EMERGING SHRIMP PATHOGENS** Jeffrey M. Lotz*, Shiao Y. Wang		**NEW PARADIGM IN FARMING OF FRESHWATER PRAWN *Macrobrachium rosenbergii* WITH CLOSED AND RECYCLE SYSTEMS** Derun Yuan*, Yang Yi, James S. Diana, C. Kwei Lin		**DIETARY ASCORBIC ACID IMPROVES GROWTH AND NON-SPECIFIC IMMUNE RESPONSES OF GROUPER *Epinephelus malabaricus* CHALLENGED WITH *Vibrio carchariae*** Mei-Fang Lin*, Shi-Yen Shiau
1500		**A PRIMARY SHRIMP CELL CULTURE SYSTEM HIGHLY PERMISSIVE FOR WHITE SPOT SYNDROME VIRUS INFECTION** Minoru Maeda*, Toshiaki Itami, Eiichi Mizuki, Michio Ohba		**COVE CULTURE OF MARBLE GOBY *Oxyeleotris marmorata* BLEEKER AND CARPS IN TRI AN RESERVOIR OF VIETNAM** V.C. Luong*, Yang Yi, C. Kwei Lin		**EFFECTS OF PROTEIN AND LIPID SOURCES ON THE GROWTH OF RED SEA BREAM *Pagrus major* AND JAPANESE FLOUNDER *Paralichthys olivaceus* RECEIVING MICROBOUND DIETS DURING LARVAL AND EARLY JUVENILE STAGE** Shin-ichi Teshima*, Shunsuke Koshio, Manabu Ishikawa, Md. Shah Alam, Luis Hector Hernandez Hernandez
1520		**DEVELOPMENT OF GENE TRANSFER TECHNOLOGY FOR SHRIMP** Ikuo Hirono*, Ryosuke Yazawa, Takashi Koyama, Anchalee Tassanakajon, Takashi Aoki		**INTEGRATED CAGE-CUM-POND CULTURE SYSTEMS WITH HIGH-VALUED SAHAR *Tor putitora* IN CAGES AND LOW-VALUED CARPS IN OPEN PONDS** Madhav K. Shrestha*, Yang Yi, James S. Diana, C. Kwei Lin, Narayan P. Pandit		**LEACHING OF SUPPLEMENTED AMINO ACIDS FROM SHRIMP DIET** Md. Shah Alam*, Shin-ichi Teshima, Manabu Ishikawa, Shunsuke Koshio, Fady Raafat Michael, Orhan Uyan and Luis Hector Hernandez Hernandez
1540	**TEA BREAK**					
1610	**CHAIR** : Paisarn Sithikornkul and Shaun Moss	**USE OF EDIBLE ANTIBODIES FOR SHRIMP HEALTH MANAGEMENT** K. Pani Prasad	**CHAIR** : Fatimah Md. Yusoff and Madhav K. Shrestha	**EFFECTS OF DIFFERENT FEEDING REGIMES ON AMMONIA EXCRETION AND FECES PRODUCTION OF FINGERLING RAINBOW TROUT *Oncorhynchus mykiss*** Muslim, In-Bae Kim, Jin Hwan Lee, Jae-Yoon Jo*	**CHAIR** : Shin-ichi Teshima and Md. Shah Alam	**OPTIMIZED FEEDING IN THAI CATFISH *Pangasius hypophthalmus* CULTURE USING SHORT TERM FEED DEPRIVATION FOLLOWED BY SUBSEQUENT REFEEDING** Mostafa A. R. Hossain*, Shaila Akter, Abul K. M. R. Amin
1630		**MONOCLONAL ANTIBODY BASED TESTS FOR DIAGNOSIS OF VIRAL AND BACTERIAL INFECTIONS IN SHRIMP AQUACULTURE** Paisarn Sithigorngul*, Parin Chaivisuthangkura, Siwapom Longyant, Sombat Rukpratanporn, Sirirat Rengpipat, Wasana Sukhumsirichart, Weerawan Sithigorngul		**INTEGRATED CAGE-CUM-POND CULTURE SYSTEMS WITH HIGH-VALUED STINGING CATFISH *Heteropneustes fossilis* IN CAGES AND LOW-VALUED CARPS IN OPEN PONDS** Md. Abdul Wahab*, Yang Yi, James S. Diana, C. Kwei Lin, Obaidullah-Al- Masud		**DIGESTIVE ENZYME PROFILE OF CATLA *Catla catla* DURING ONTOGENIC DEVELOPMENT** Rina Chakrabarti, Raja Mansingh Rathore, Sunil Kumar
1650		**THE RELATIONSHIP OF A PUTATIVE POLYMERASE GENE AND TAXONOMY OF A DNA BACTERIOPHAGE OF *Vibrio harvei*** T. Pasharawipas*, S. Thaikua, T.W. Flegel		**CODE OF CONDUCT GUIDELINES IN DESIGNING TWO AQUACULTURE FACILITIES** Phillip T. Arumugam*		**EFFECT OF DIETARY PROTEIN SOURCES ON GROWTH, PROTEASE AND AMYLASE ACTIVITY OF JUVENILE *Macrobrachium rosenbergii* AT DIFFERENT GROWTH PERIODS** Lizy Behanan, Saleena Mathew*
1710				**MODELING AND COMPUTERIZING VISUAL ASSESSMENT OF AN ARTIFICIAL INTEGRATED AGRICULTURE - AQUACULTURE SYSTEM** H. Khoda Bakhsh*, A.R. Alimon, Rashid Shariff, A. Christianus, M.Y. Khanif, W.A. Wan Adnan		**IMPACT OF SUBSTRATES AND FISH STOCKING DENSITY ON THE GROWTH AND PRODUCTION OF THE INDIAN MAJOR CARP *Labeo rohita* (HAM.)** P. Keshavanath*, B. Gangadhara, T.J. Ramesha, M. Priyadarshini

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		Serindit Increasing Aquaculture Productivity (Reproductive Physiology)		**Tekukur** Value Added Products (Nutritional Quality, Post -Harvest Technology)		**Bayan** Technology Needs and Prospects for Asian Aquaculture
0900		**OPENING CEREMONY** (GRAND BALLROOM)				
1000		**TEA BREAK** (GRAND BALLROOM FOYER)				
1030		**KEYNOTE 1: DR. MERYL J. WILLIAMS** (GRAND BALLROOM)				
1130		**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)				
1400	**CHAIR :** Michael S.H. Cheah and Amrit Bart	**INTERSPECIFIC AND INTRASPECIFIC VARIATIONS OF *Echinometra* SPECIES IN OKINAWA** Sk. Mustafizur Rahman*; Tsuyoshi Uehara	**CHAIR :** A. Ramachandran	**AN ASSESSMENT OF TEXTURAL VARIATIONS OF MUSCLE TISSUES OF *Labeo rohita* AND *Scollodon sorrokawah* WITH EMPHASIS ON COLLAGEN** Maya Raman*, Saleena Mathew	**CHAIR :** Madan Dey	**·CHANGING STRUCTURE OF FISH CONSUMPTION, PRODUCTION, AND TRADE: THE ROLE OF AQUACULTURE IN THE ASIAN DEVELOPING COUNTRIES** Mohammed A. Rab*, Madan Dey, Mahfuzuddin Ahmed
1420		**IGF-I, IGF-II AND IGF-IR AS MOLECULAR MARKERS FOR EGG QUALITY** Josette Bangcaya*, Josephine Nocillado, Alex Anderson, Mike Rimmer, Peter Fry and Abigail Elizur		**IMPROVEMENT OF QUALITIES OF TRADITIONAL MARINE DRIED PRODUCTS USING A LOW COST SOLAR DRIER** Md. Kamal*, Md. Reza, Akhteruzzman, Chris Morrice		**DEMAND FOR FISH IN ASIA: A CROSS-COUNTRY ANALYSIS** Yolanda Tan-Garcia
1440		**IMPACT OF DIETARY *Quillaja saponins* ON GROWTH, SEX RATIO AND REPRODUCTION OF NILE TILAPIA *Oreochromis niloticus* UNDER FIELD CONDITIONS IN BANGLADESH** Silke Steinbronn*, Md. Arshad Hossain, George Francis, Ulfert Focken, Klaus Becker		**A PRELIMINARY STUDY ON THE AMINO ACID AND NUCLEOTIDE PROFILE IN TILAPIA *Oreochromis niloticus* WASTE** Nizaha Juhaida Mohamad*, Noryati Ismail, Ismail Ishak		**FINDING NEMO: ESTIMATING IMPORT DEMAND FOR LIVE REEF FOOD FISH** Elizabeth Helen Petersen, Geoffrey Muldoon, Brian Johnston
1500		**THE REPRODUCTIVE BIOLOGY OF *Polymesoda erosa* FROM NORTHERN AUSTRALIA** Ricky Gimin, Luong-Van Thinh*, Ram Mohan, A.D. Griffiths		**FACTORS AFFECTING THE NUTRITIONAL COMPOSITION OF SNAKEHEAD *Channa punctatus*** Sk. Mustafizur Rahman*; Md. Abdul Bari; Md. Moshiur Rahman; Md. Noman Siddiqui and Md. Nazmul Ahsan		**PROJECTIONS AND SCENARIOS FOR ASIAN FISHERIES: THE ROLE OF PRODUCTIVITY IMPROVEMENTS IN AQUACULTURE** M.Dey and associates
1520		**SEASONAL OVARIAN CHANGES IN THE SPOTTED SNAKEHEAD *Channa punctatus* UNDER CAPTIVITY** K. Marimuthu*, M.A. Haniffa, Rosh ada Hashim		**MONTHLY VARIATION IN THE BODY COMPOSITION OF SNAKEHEAD *Channa punctatus* (BLOCH, 1974)** Quazi Zahangir Hossain*, Sk. Mustafizur Rahman, Md. Abdul Bari, Ayaz Hasan Chisty, Md. Nazmul Ahsan		**PROFILE OF BRACKISHWATER AND MARINE AQUACULTURE TECHNOLOGY IN ASIA** Roslina Kamaruddin, Ferdinand Paraguas
1540		**TEA BREAK**				
1610	**CHAIR :** Michael S.H. Cheah and Amrit Bart	**DETERMINATION OF SPAWNING SEASON OF *Garra rufa* (CYPRINIDAE: GARRINAE) BASED ON THREE INDICES** H.R. Esmaeili*, M. Yazdanpanah	**CHAIR :** A. Ramachandran	**BIOCHEMICAL EVALUATION OF *Pangasius hypothalamus* STORED IN ICE AND AT AMBIENT TEMPERATURE** Khairul Azami*, Abul Farah Md. Hasanuzzaman	**CHAIR :** Madan Dey	**PRIORITY OPTIONS ON TECHNOLOGY AND POLICY FOR ASIAN AQUACULTURE** M. Dey and associates
1630		**SEASONAL SPAWNING CYCLES OF *Aequipecten opercularis* AND *Pecten maximus* (MOLLUSCA; PECTINIDAE) FROM THE LAXEY BAY AND PORT ST. MARY FISHING GROUNDS IN THE NORTH IRISH SEA, ISLE OF MAN, UNITED KINGDOM** Tikiri B. Wanninayake*, Andrew R. Brand		**EFFECT OF DIFFERENT HANDLING PRACTICES ON THE QUALITY OF ICE- STORED TILAPIA *Oreochromis mossambicus* USING QUALITY INDEX METHOD (QIM)** P.S. Jayasinghe*, C. Galappaththi		**STRUCTURE AND PROCESSES OF INPUT MARKETS FOR AQUACULTURE IN THE PHILIPPINES: IMPLICATIONS ON AQUACULTURE'S SUSTAINABLE DEVELOPMENT** Nerissa D. Salayo
1650		**GONADAL CHANGES IN WILD FRESHWATER SPINY EEL *Mastacembelus armatus* IN EARLY SPENT PERIOD** M.M. Rahman, G.U. Ahmed, S.M. Rahmatullah		**PROCESS ACCOUNTING APPLICATION TO SHRIMP PROCESSING** Jose P. Peralta		**NILE TILAPIA SEED PRODUCTION IN SPRING IRRIGATED RICE-FIELDS IN NORTHWEST BANGLADESH – AN APPROACH APPROPRIATE FOR POORER FARMERS?** Benoy Kumar Barman*, David C. Little
1710		**OBSERVATION ON THE EMBRYONIC DEVELOPMENT OF BAGRID CATFISH *Pelteobagrus fulvidraco*** Wang Weimin, Yan Ansheng, Zha Jinmiao, Zhang Zhiguo		**LACTIC ACID TREATMENT OF REFRIGERATED TILAPIA FILLETS** Jamilah Bakar*, Lau Kheng Hock		**TOWARDS LOCAL PRODUCTION AND AVAILABILITY OF QUALITY FISH SEED IN ASIA-INCREASING BENEFITS TO THE RURAL POOR** David C.Little*, Benoy K. Barman
1730		**CRYOGENIC FISH SPERM BANK IN ASIA : THE ROLE OF AQUACULTURE PROGRAM AT THE ASIAN INSTITUTE OF TECHNOLOGY (AIT)** Amrit N. Bart		**APPLICATION OF QUALITY INDEX METHOD IN DETERMINING THE SHELF LIFE OF SKIPJACK TUNA *Katsuwonus pelamis*** B.M.K. Waduressa, B.H.M.N. De Silva, K.W.S. Ariyawansa*		**CONTRIBUTION OF SELF-RECRUITING SPECIES OF AQUATIC ANIMALS PRODUCED IN FARMER-MANAGED SYSTEMS TO URBAN FOOD SUPPLIES IN NORTHERN VIETNAM** Ernesto J. Morales*, David C. Little, Elsa Amilhat, Kai Lorenzen, Harvey Demaine, Amara Yakupitayage, Kim Van Van

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		Pekaka Restoring & Sustaining Capture Fisheries (Managemant Measures)		**Merbah 2** Fisheries Co-Management
0900		**OPENING CEREMONY** (GRAND BALLROOM)		
1000		**TEA BREAK** (GRAND BALLROOM FOYER)		
1030		**KEYNOTE 1: DR. MERYL J. WILLIAMS** (GRAND BALLROOM)		
1130		**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)		
1400	**CHAIR** : Sena DeSilva	**THE LONG-TERM IMPACT OF COASTAL RESOURCES MANAGEMENT IN PANGUIL BAY, PHILIPPINES** Danilo C. Israel	**CHAIR** : Kuperan Viswanathan	**WOMEN'S ROLE IN COMMUNITY BASED FISHERIES MANAGEMENT PROJECT-2** Ms. Nargis Akter
1420		**MANAGEMENT OPTIONS FOR TROPICAL SHAD *Tenualosa* FISHERIES IN SOUTH AND SOUTHEAST ASIA** Stephen J.M. Blaber		**DIFFERENT APPROACHES OF COMMUNITY BASED FISHERIES MANAGEMENT: PROSHIKA EXPERIENCE IN BANGLADESH** Sabuj Kumar Chowdhury
1440		**THE TAB: AN EMERGING (SUB-) REGIONAL FISHERIES ORGANIZATION FOR THE MEKONG? WHY WE NEED IT, AND WHAT IT SHOULD DO?** Wattana Leelapatra*, Magnus Torell, Wolf Hartmann		**COMMUNITY ENTERPRISE ON FISHERIES FOR SUSTAINABLE AND EQUITABLE DEVELOPMENT IN FLOOD-PLAIN AREA- A POVERTY REDUCTION STRATEGY** Sakiul Millat Morshed*, Nurul Haque Sujon, Shikkha Shastha Unnayan Karzakram
1500		**IMPACTS OF IRRIGATION ON FISHERIES IN RAINFED RICE FARMING LANDSCAPES** Kai Lorenzen, Sophie Nguyen-Khoa, Caroline Garaway,Bounthanom Chamsinhg, Darrell Siebert		**AN ANALYSIS OF CO-MANAGEMENT ARRANGEMENTS: CASE OF A FISHING DISTRICT IN FIJI ISLANDS** Patrick Sakiusa Fong*, Joeli Veitayaki, Bill Aalbersberg
1520		**PEOPLE AND POLICY CHANGE IN INDIAN FISHERIES** S.D. Tripathi*, G. Haylor, W. Savage		**FISHING FOR THE FUTURE: CO-MANAGEMENT AND THE INTRODUCTION OF RIGHTS-BASED FISHERIES MANAGEMENT SYSTEMS** Theo Ebbers*, Sammy Malvas
1540		**TEA BREAK**		
1610	**CHAIR** : Sena DeSilva	**DEVELOPING A SYSTEM OF EFFECTIVELY MANAGED MARINE SANCTUARIES IN THE PHILIPPINES: A NATIONAL NETWORK STRATEGY** Margarita Lavides*, Fernando Tiburcio, Jose Ma. Antonio Bringas, Isidore Ancog	**CHAIR** : Kuperan Viswanathan	**MISSING THE FISH FOR THE TREES? FISHERIES CO-MANAGEMENT AND COMMUNITY FORESTRY IN SOUTHEAST ASIA – LESSONS TO BE LEARNED** Wolf Hartmann*, Vitoon Viriyasakultorn
1630		**AN ARIMA (0, 1, 1) MODEL AND BOOTSTRAP ESTIMATION FOR FORECASTING THE ANNUAL TOTAL MARINE FISH PRODUCTION IN MALAYSIA** Mahendran Shitan*, Chin Hong Yee, R.P.P.K. Jayasinghe		**FISHERIES CO-MANAGEMENT IN LAO PDR – THE USER PERSPECTIVE** Sommano Phounsavath*, Reservoir Fisheries Management Committees of Nam Houm, Nam Suang, Huei Siet, Pak Beung, Wolf D. Hartmann
1650		**POTENTIAL ACCESS RIGHTS AND GOVERNANCE OF THE COASTAL POOR COMMUNITIES FOR HARVEST AND CULTURE OF MOLLUSKS IN BANGLADESH COAST** M.A. Salam*, A. Karmoker, T.A. Mukta, M.A.R. Hossain		**ALTERNATIVE SOURCES OF INCOME: A WAY OUT IN FISHERIES MANAGEMENT?** Kaing Khim*, Wolf D. Hartmann
1710		**IDENTIFICATION OF SIMPLE INDICATORS OF ECOSYSTEM HEALTH AND EXPLOITATION STATUS IN THE SHRIMP FISHERY IN SOUTH VIETNAM** Steen Christensen*, Dang van Thi, Douglas Clyde Wilson, Truong Hoang Minh		**TRAGEDY OF THE RESOURCES OWNERSHIP IN MARINE PROTECTED AREA: CASE STUDY IN WEST-LOMBOK, INDONESIA** Arif Satria*, Yoshiaki Matsuda, Masaaki Sano
1730		**BOOM AND BUST FISHERIES IN THE PHILIPPINES: MONITORING A NEW SEAHORSE FISHERY IN NORTHERN BOHOL FOR MANAGEMENT INSIGHTS** H. Panes*, B. Giles, S. Morgan, D. McCorry, A.C.J. Vincent		

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		Murai 1 Production in Aquatic Peri-urban Systems in Southeast Asia		**Murai 2** Socio-Economic Perspectives (Eco-Labeling, Economic Policies & Institutions)
0900	**OPENING CEREMONY** (GRAND BALLROOM)			
1000	**TEA BREAK** (GRAND BALLROOM FOYER)			
1030	**KEYNOTE 1: DR. MERYL J. WILLIAMS** (GRAND BALLROOM)			
1130	**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)			
1400	**CHAIR** : David Little	**THE CURRENT STATUS OF PERI-URBAN AQUATIC FOOD PRODUCTION SYSTEMS IN SE ASIA: AN OVERVIEW OF FOUR CITIES, BANGKOK, PHNOM PENH, HO CHI MINH CITY AND HANOI** David Little*, Stuart Bunting, Will Leschen.	**CHAIR** : Ida M. Siason	**SUSTAINABILITY, ECOLABELLING AND ASIAN FISHERIES** Frazer McGilvray
1420		**URBAN DEVELOPMENT, LAND POLICY AND THE FUTURE OF PERI-URBAN AQUATIC FOOD PRODUCTION SYSTEMS IN SOUTHEAST ASIA** Jonathan Rigg*, Albert M Salamanca		**PUBLIC AND PRIVATE SECTOR INSTITUTIONAL ARRANGEMENTS IN FISH GENETIC RESEARCH AND DEVELOPMENT: ISSUES AND RECOMMENDATIONS FROM PHILIPPINES CASE STUDY** Belen O. Acosta*, Ruben C. Sevilleja, Basilio M. Rodriguez,Modadugu V. Gupta, Tereso Abella, Melchor Tayamen
1440		**AN OVERVIEW OF THE CURRENT STATUS OF PERI-URBAN AQUATIC FOOD PRODUCTION SYSTEMS IN PHNOM PENH** Chouk Borin*		**USER VALUES OF AQUATIC RESOURCES IN THE LOWER MEKONG BASIN: EMPIRICAL EVIDENCES** Bee Hong Yeo*, Danilo C. Israel, Mahfuzuddin Ahmed, Meen Chee Hong, E. K Heng
1500		**STATE OF PERI-URBAN AQUACULTURE SYSTEMS, MARKETING CHANNELS OF AQUATIC PRODUCTS AND INSTITUTIONAL STRUCTURE FOR AQUACULTURE IN HO CHI MINH CITY** Le Thanh Hung*, Huynh Pham Viet Huy		**ECONOMIC LOSS FROM FISH DISEASES ON RURAL FRESHWATER AQUACULTURE OF BANGLADESH** Md. Ali Reza Faruk*
1520		**THE STATUS OF PERI-URBAN AQUATIC PRODUCTION SYSTEMS IN HANOI** Pham Anh Tuan*, Nguyen Thi Dieu Phuong		**ECONOMIC VALUATION, ACCESS ANALYSIS, AND STAKEHOLDER-BASED PLANNING FOR AQUATIC RESOURCES MANAGEMENT IN THE LOWER MEKONG BASIN** Danilo C. Israel*, Mahfuzuddin Ahmed, Yeo Bee Hong
1540	**TEA BREAK**			
1610	**CHAIR** : David Little	**STATE OF PERI-URBAN AQUATIC FOOD PRODUCTION SYSTEMS IN BANGKOK** Ruangvit Yoonpundh*, Varunthat Dulaypurk, Chumpol Srithong	**CHAIR** : Ida M. Siason	**SOCIOECONOMIC IMPACT OF AQUACULTURE EXTENSION PROJECTS IN IMPROVING LIVELIHOODS OF FISH FARMERS IN BANGLADESH** M. Serajul Islam*, M. Harun-Ar Rashid
1630		**EVALUATING PARTICIPATORY ACTION PLAN DEVELOPMENT IN FORMULATING SUSTAINABLE MANAGEMENT STRATEGIES FOR PERI-URBAN AREAS, WITH EMPHASIS ON THE EAST KOLKATA WETLANDS** Nitai Kundu, Mousumi Pal, Samarpita Ray Chaudhuri, Stuart Bunting		**TOWARDS SUSTAINING MARINE AND FISHERIES CONSERVATION: ECONOMIC VALUATION FOR CONSERVING THE TUBBATAHA REEFS, PHILIPPINES** Rodelio F. Subade
1650				**AN EVALUATION OF THE EFFECTIVENESS OF A CHILD TO CHILD EXTENSION MODEL FOR PROMOTING EFFECTIVE POND AQUACULTURE IN RURAL BANGLADESH** C.P. Morrice*, D. Brown, S. Islam
1710				**INSTITUTIONAL ARRANGEMENT ANALYSIS (IAA) OF INDIAN SHRIMP FARMING – STAKE HOLDERS CHARACTERISTICS AND THEIR ATTRIBUTES ON ISSUES OF SUSTAINABILITY IN SHRIMP FARMING SECTOR** D. Seenappa, C. Vasudevappa, Y.S. Arunkumar, Denis Bailly

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		Grand Ballroom 1 Advances in Shrimp Biotechnology 2 (Shrimp Genetics, Viral Pathogens)		Grand Ballroom 2 Promoting Environment-Friendly Management (Environmental Management)		Grand Ballroom 3 Increasing Aquaculture Productivity (Nutrition & Feed Management)
0830		KEYNOTE 2: DR. MAHFUZUDDIN AHMED				
0930		TEA BREAK				
1000	CHAIR : Amornrat Phongdara and Sirawut Klinbunga	DEVELOPMENT OF AFLP GENETIC MARKERS FOR FAST GROWTH TRAITS AND SEX OF THE BLACK TIGER SHRIMP *Penaeus monodon* Kanokporn Triwitayakorn*, Supajit Sraphet, Benchamart Moolmung,Duncan R. Smith, Sakol Panyim	CHAIR : Jae-Yoon Jo and Phillip T. Arumugam	INDIGENOUS TECHNICAL KNOWLEDGE (ITK) IN THE CONSERVATION OF COASTAL BIODIVERSITY IN BANGLADESH Anwara Begum*, M. Mizanur Rahman, K.M. Nurul Islam, Md. Saifuddin Shah	CHAIR : Shiau Shi-Yen and Bidhan C. Patra	ABSORPTION OF AMINO ACIDS AT DIFFERENT SITES OF THE GUT IN AN INDIAN MAJOR CARP *Labeo rohita* (HAMILTON) Bidhan C. Patra*
1020		SEX-RELATED AFLP MARKERS AND GENE EXPRESSION IN ANDROGENIC GLANDS OF THE GIANT FRESHWATER PRAWN *Macrobrachium rosenbergii* Rachanimuk Preechaphol*, Sirawut Klinbunga, Padermsak Jarayabhand, Piamsak Menasveta		REDUCTION OF PRODUCTION COST AND MANAGEMENT OF ALGAE IN PANGAS *Pangasius hypophthalmus* PONDS THROUGH INCORPORATION OF SILVER CARP *Hypophthalmicthys molitrix* Md. Mahfuzul Haque*, Md. Reaz Uddin Sarkar, Saleha Khan		EVALUATION OF MIXED FEEDING SCHEDULES WITH VARYING DIETARY PROTEIN CONTENT ON THE GROWTH PERFORMANCE AND REDUCTION OF COST OF PRODUCTION FOR PANGAS WITH SILVER CARP M. A. Hossain*, M.Z. Ali, M. M. Rahman, M.A. Kader
1040		GENETIC VARIATION OF *Penaeus merguiensis* IN THAILAND Amornrat Phongdara*, Warapom Wanna, Jean-Luc Rolland, François Bonhomme		EFFECT OF LIMNOLOGICAL CHARACTERISTICS ON CULTURE-BASED FISH YIELD IN NON-PERENNIAL RESERVOIRS OF SRI LANKA U. Asanka D. Jayasinghe*, Upali S. Amarasinghe, Sena S. De Silva		GROWTH PERFORMANCE, FEED UTILIZATION EFFICIENCY AND DIGESTIVE ENZYME ACTIVITY IN ROHU *Labeo rohita* FINGERLINGS FED YEAST EXTRACT POWDER (YEP) SUPPLEMENTED DIETS Arun Kumar Ray*, Koushik Ghosh, Sukanta Kumar Sen
1100		DIFFERENTIALLY EXPRESSED cDNA MARKERS IN OVARIES AND TESTES OF THE GIANT TIGER SHRIMP *Penaeus monodon* Rungnapa Leelatanawit*, Sirawut Klinbunga, Narongsak Puanglarp, Anchalee Tassanakajon, Padermsak Jarayabhand, Ikuo Hirono, Takashi Aoki, Piamsak Menasveta		PARTICIPATORY RESOLUTION OF WATER USE CONFLICTS IN A MIXED SHRIMP - RICE CULTURE AREA OF THE MEKONG DELTA Nguyen Khac Thanh*, Paula Brown		POPULATION DYNAMICS OF A COMMON BRACKISH WATER ZOOPLANKTON SPECIES ENRICHED WITH COMMERCIAL PROBIOTICS, INERT FEED AND BAKER'S YEAST Mohd.Fanduddin Othman*, K. Subramaniam, Rosnani Yaakob, Fadzil Harun
1120		GENETIC DIVERSITY AND POPULATION STRUCTURE OF THE GIANT TIGER SHRIMP *Penaeus monodon* IN THAILAND Sirawut Klinbunga*, Siriporn Pongsomboon, Premruethai Supungul, Bavornlak Khamnamtong, Supaporn Thamrungtanakit, Anchalee Tassanakajon, Piamsak Menasveta		REVISITING UNDERLYING ECOLOGICAL PRINCIPLES OF RICE-FISH INTEGRATED FARMING FOR ENVIRONMENTAL, ECONOMICAL AND SOCIAL BENEFITS Tek Bahadur Gurung*, Suresh Kumar Wagle		DEVELOPMENT OF A SUITABLE DIET USING LOCALLY AVAILABLE FEED INGREDIENTS FOR MONOCULTURE OF GIANT FRESHWATER PRAWN *Macrobrachium rosenbergii* IN PONDS M. A. Hossain*, L. Paul, M. R. Hasan
1140		DEVELOPMENT OF MOLECULAR MARKERS FOR DIFFERENTIATION OF MORPHOLOGICALLY SIMILAR *Penaeus* SPECIES Bavornlak Khamnamtong*, Sirawut Klinbung, Piamsak Menasveta		SUSTAINABLE ORGANISATIONS OF AQUACULTURE FOR PROPER RESOURCE UTILISATION – BALANCING WATER AND SOIL CONFLICTS N. Rajalakshmi		INTERACTIVE EFFECTS OF DIETARY PROTEIN AND CARBOHYDRATE LEVELS ON GROWTH, NUTRIENT UTILIZATION AND BODY COMPOSITION IN ROHU *Labeo rohita* FINGERLINGS Arun Kumar Ray*, Bana Behari Satpathy
1200	CHAIR : Takashi Aoki and Kenneth Soderhall	RECENT ADVANCES IN CRUSTACEAN IMMUNITY Kenneth Söderhäll*, Irene Söderhäll		IMPACT OF SHRIMP CULTURE ON NATURAL RESOURCES OF MUNDEL LAKE IN SRI LANKA A.S.L.E. Corea*, J.M.P.K. Jayasinghe, W.A.L. Wickramasinghe		USE OF L-ASCORBYL-2-MONOPHOSPHATE-NA/CA AS A VITAMIN C SOURCE FOR JUVENILE KURUMA SHRIMP *Marsupenaeus japonicus* (BATE) Yin Yin Moe*, Shunsuke Koshio, Shin-ichi Teshima, Manabu Ishikawa
1220				INTENSIVE SHRIMP CULTURE IN ZERO AND LIMITED WATER EXCHANGE PONDS Pohan Panjaitan, Ram Mohan, Jim Luong-Van		IMPACT OF FEEDING STRATEGIES ON THE GROWTH AND BODY COMPOSITION OF STRIPED CATFISH *Pangasius hypopthalmus* Kanjana Payooha*, Amararatne Yakupitiyage
1240		SPECIFICITY IN THE SHRIMP IMMUNE RESPONSE REVEALED BY DIFFERENTIAL DISPLAY Karla Montaño Pérez*, Alba I. Gómez Gámez, Francisco Vargas Albores		WHO GAINS, WHO LOSES WHAT FROM SHRIMP CULTIVATION AROUND SUNDARBANS: A CASE STUDY OF SELECTED VILLAGES OF RAMPAL UPAZILA, BANGLADESH Md. Rezaul Karim		EFFECTS OF DIETARY SUBSTITUTION OF TUNA MUSCLE BY-PRODUCT POWDER FOR FISH MEAL ON GROWTH, BODY COMPOSITION AND PHOSPHORUS LOADING IN JUVENILE JAPANESE FLOUNDER *Paralichthys olivaceus* Orhan Uyan*, Shunsuke Koshio, Shin-Ichi Teshima, Manabu Ishikawa, Moe Thu, Fady Raafat Michael, Md. Shah Alam
1300		LUNCH and POSTER VIEWING (MATAHARI BALLROOM)				
1430	CHAIR : Takashi Aoki and Kenneth Soderhall	MOLECULAR BIODEFENSE MECHANISM IN KURUMA SHRIMP AND BLACK TIGER SHRIMP Takashi Aoki*, Ikuo Hirono	CHAIR : M A. Ambak and Md. Abdul Wahab	FEEDING ENHANCES ANTI- *Vibrio harveyi* ACTIVITY OF *Tilapia hornorum* IN A SIMULATED SHRIMP CULTURE SYSTEM Eleonor A. Tendencia	CHAIR : Roshada Hashim and Chutima Tantikitti	EFFECT OF DIETARY PROTEIN-TO-LIPID RATIO ON GROWTH AND BODY COMPOSITION OF BAGRID CATFISH *Mystus nemurus* M.N. Afini*, R. Hashim
1450				USING ENVIRONMENTAL CAPACITY IN TROPICAL AQUACULTURE – THE TROPECA APPROACH Rod Cappell*, John Hambrey		CHEMICAL POTENTIAL OF LABLAB Ida G. Pahila
1510		EXPRESSED SEQUENCE TAG ANALYSIS FOR IDENTIFICATION OF HEAT RELATED GENES IN THE GIANT TIGER SHRIMP *Penaeus monodon* Atchariya Buethong*, Narongsak Puanglarp, Anchalee Tassanakajon, Piamsak Menasveta		EFFECTIVENESS OF DIFFERENT PERIPHYTON SPECIES IN IMPROVING WATER QUALITY H. Khatoon*, F.M. Yusoff, M. Shariff, H.M. Peralta		EFFECTS OF DIETARY CARBOHYDRATE TO LIPID RATIO WITH TWO LEVELS OF PROTEIN ON THE GROWTH PERFORMANCE, BODY COMPOSITION AND HEPATOSOMATIC INDEX OF RAINBOW TROUT *Oncorhynchus mykiss* A.M. Abedian*, A. Meshkat Rohani, F. Shariatmadarei
1530		STRESS RESPONSES IN GIANT TIGER SHRIMP *Penaeus monodon* Narongsak Puanglarp*, Atchariya Buethong, Kanchana Doungpunta, Padermsak Jarayabhand, Piamsak Menasveta		INCREASED SHRIMP BIOMASS AFFECTS EFFICIENCY, AGAINST *Vibrio harveyi*, OF FISH CUM SHRIMP INTEGRATED CULTURE SYSTEM Eleonor A. Tendencia		EFFECT OF TEMPERATURE, SALINITY AND STOCKING DENSITY ON DEVELOPMENT OF MASS CULTURE OF *Isochrysis galbana* AND *Nannochloropsis ocullata* FOR BREEDING Le Xan, Do Xuan Hai
1550		TEA BREAK				
1620	CHAIR : Takashi Aoki and Kenneth Soderhall	IMMUNE RELATED WAP DOMAIN-CONTAINING PROTEINS FROM *Litopenaeus vannamei* HEMOCYTES Florinda Jiménez Vega, Francisco Vargas Albores*	CHAIR : M.A. Ambak and Md. Abdul Wahab	PRESENCE OF SNAPPER, SEABASS, AND SIGANID INHIBITS GROWTH OF LUMINOUS BACTERIA IN A SIMULATED SHRIMP CULTURE SYSTEM Eleonor A. Tendencia	CHAIR : Roshada Hashim and Chutima Tantikitti	USE OF LOW FISHMEAL FEEDS IN AQUACULTURE OF THE COBIA *Rachycentron canadum* Houng-Yung Chen
1640		GENE EXPRESSION IN HEMATOPOIETIC TISSUE OF BLACK TIGER SHRIMP *Penaeus monodon* BY THE EST APPROACH Kallaya Sritunyalucksana*, Wanwarang Hiriote		THE EFFECTS OF LIGHT INTENSITY ON THE GROWTH OF DIFFERENT MARINE ALGAL SPECIES Z. Mohd-Rozhan*, F.M. Yusoff, H. Khatoon, Ken Furuya		PARTIAL REPLACEMENT OF FISHMEAL BY SOYBEAN MEAL IN THE DIET OF ROHU *Labeo rohita* (HAMILTON) FRY D.A. Jahan*, L. Hussain, M.A. Islam
1700		SERINE PROTEINASE AND KAZAL INHIBITOR FROM *Litopenaeus vannamei* HEMOCYTES Florinda Jiménez-Vega, Francisco Vargas-Albores*		REINFORCEMENT FOR PULLING OUT RESISTANCE OF THE SELF EXPENDABLE PILE ANCHOR Gil-Su Yoon		POTENTIAL OF SUBSTRATE BASED MICROBIAL BIOFILM FOR NURSERY REARING OF MRIGAL *Cirrhinus mrigala* AND FRESHWATER PRAWN *Macrobrachium rosenbergii* IN CEMENT TUBS J.K. Manissery*, R.M. Mridula, P. Keshavanath, K.M. Shankar, M.C Nandeesha, K.M. Rajesh
1720						FEED ATTRACTANTS FOR THE FRESHWATER PRAWN *Macrobrachium rosenbergii* D.D. Nambudiri*, P.M. Sherief, Sajan George, C. Mohanakumaran Nair

	Serindit Increasing Aquaculture Productivity (Genetics & Biotechnology)	**Tekukur** Value Added Products (Quality & Safety Standards), Promoting Environment-Friendly Management (Reducing Risks of Diseases)	**Bayan** Technology Needs and Prospects for Asian Aquaculture, Mariculture in the Asia-Pacific Region
0830	**KEYNOTE 2: DR. MAHFUZUDDIN AHMED** (GRAND BALLROOM)		
0930	**TEA BREAK** (GRAND BALLROOM FOYER)		
1000	CHAIR : Siti Azizah Mohd. Nor **GENERATING RESOURCES TO CONTINUE TILAPIA GENETIC IMPROVEMENT R&D THROUGH PUBLIC-PRIVATE SECTOR PARTNERSHIPS IN THE PHILIPPINES** Basilio M. Rodriguez Jr.	CHAIR : Jamilah Bakar **HACCP & AQUACULTURE** Reza SHahifar *, Kazem Abdee	CHAIR : Madan Dey **UPTAKE OF TILAPIA GENETICS-BASED TECHNOLOGIES THROUGH PUBLIC-PRIVATE PARTNERSHIPS** Ruben C. Sevilleja*, Melchor M. Tayamen, Tereso A. Abella
1020	**PERFORMANCE OF STERILE COMMON CARP *Cyprinus carpio* IN POLYCULTURE PONDS** G.P. Satyanarayana Rao*, K.V. Mohire	**PIGMENT EXTRACTION FROM *Acipenser guldenstadti* AND *Acipencer persicus* CAVIAR BY HPLC METHOD** Shahrooz Ghasemi*, Yazdan Moradi	**IMPACT OF ENHANCED AQUACULTURE KNOWLEDGE ON THE SOCIO-ECONOMIC STATUS OF FISH FARMERS IN BANGLADESH** C.P. Morrice*, B.K. Mahalder, N.I. Chowdhury
1040	**MOLECULAR DATA FROM THE 16S rRNA FOR THE PHYLOGENY OF CHANNIDAE *Channa sp.* IN MALAYSIA** Ambok Bolong Abol-Munafi, Bui Minh Tam*, Patimah Ismail, Mohd Azmi Ambak	**MICROBIOLOGICAL QUALITY OF SHRIMP *Penaeus monodon* IN RELATION TO PHYSICO-CHEMICAL FACTORS IN WATER SOURCES** K.W.S. Ariyawansa*, U. Samarajeewa, S.P. Jayasooriya	**SMALL-SCALE AQUACULTURE IN UPLAND AREAS OF YEN CHAU DISTRICT, SON LA PROVINCE / NORTHERN VIETNAM** Silke Steinbronn*, Nguyen Ngoc Tuan, Ulfert Focken, Klaus Becker
1100	**COMPARATIVE STUDY OF GENETIC VARIABILITY BETWEEN RIVER AND HATCHERY STOCKS OF *Catla catla* BY MICROSATELLITE ANALYSIS** Md. Samsul Alam*, Md. Shahidul Islam	**IMPLEMENTING TQM IN SEAFOOD INDUSTRY IN KERALA, INDIA** A. Ramachandran*, Smitha Nair, K.G. Sunil	**LOCAL RESOURCE USERS GROUPS – AN APPROACH OF IMPROVING FARMER-MANAGED AQUATIC SYSTEMS** Ernesto J. Morales*, David C. Little, Harvey Demaine, Amara Yakupitayage, Khong
1120	**CRYOPRESERVATION OF SPERMATOZOA OF INDIAN MAJOR CARPS AND OTHER CULTURE SPECIES IN BANGLADESH** Md. Rafiqul Islam Sarder	**FACTORIAL STUDY OF VARIOUS CHEMICALS AND NaCl EFFECTS ON THE GROWTH AND TOXIGENESIS OF *C. botulinum* AND *E.coli* IN A BHI BROTH MODEL EXPECTED FOR CAVIAR FORMULATION** Vadood Razavilar	**ENHANCING FISHERIES DEVELOPMENT THROUGH FOCUSED SUPPORT TO STATE FUNDED UNIVERSITIES IN BANGLADESH** M. Akhteruzzaman *, Christopher Paul Morrice
1140	**COMPARISON OF GROWTH AND REPRODUCTION OF WILD AND HATCHERY PRODUCED STRAINS OF INDIAN MAJOR CARPS** Md. Saifuddin Shah		**SEAWEED CULTURE AS A LIVELIHOOD OPTIONS FOR THE POOR COASTAL COMMUNITIES OF BANGLADESH** Mohammad Zafar
1200	**ALLOZYME VARIATION OF HATCHERY AND RIVER POPULATIONS OF ROHU *Labeo rohita* IN BANGLADESH** Md. Mukhlesur Rahman Khan*, Mohammad Shafiqul Alam, Mohammad Maqueshudul Haque Bhuiyan		**RAISING FISH IN DEEPWATER RICE AGRO-ECOSYSTEM: A NEOREALISTIC APPROACH FOR PROMOTION OF INDIAN RURAL AQUACULTURE** D. N. Das
1220	**GENETIC VARIATION IN THREE RIVER POPULATIONS OF *Cirrhinus cirrhosus*** Md. Abul Hasanat*, Md. Mukhlesur Rahman Khan, Md. Samsul Alam, Md. Fazlul Awal Mollah		**SOCIOECONOMIC PROFILE OF FISH FARMERS AND HOUSEHOLDS IN RELATED SECTORS: IMPLICATIONS FOR PRO-POOR DEVELOPMENT OF AQUACULTURE IN THE PHILIPPINES** R. L. Tan, Sheryl Ma, M. Navarez, Melanie B. Lee, Y. Tan-Garcia*
1240	**NETWORKING IN RESEARCH: SUCCESS STORY OF INTERNATIONAL NETWORK ON GENETICS IN AQUACULTURE (INGA)** Modadugu V. Gupta, Belen O. Acosta*		**AQUACULTURE SUCCEEDS SUPERCYCLONE – SUSTAINABLE CARP CULTURE IN COASTAL AGRO-ECOSYSTEM OF ORISSA COAST (INDIA)** B.B. Sahu*, H. K. De, M. K. Pati, K.C. Pani S. K. Sarkar, N. Sarangi
1300	**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)		
1430	CHAIR : Mariana Nor Shamsudin **CURRENT STATUS OF GENETICS IN AQUACULTURE IN IRAN** MohammadReza Kalbassi*, Saeed Keyvanshokooh	CHAIR : R. Dinakaran Michael and Sohrab Akbari **PLANT-DERIVED IMMUNOSTIMULANTS – AN ATTRACTIVE ALTERNATIVE TO VACCINES IN FINFISH AQUACULTURE?** R. Dinakaran Michael	CHAIR : Michael Phillips **AN OVERVIEW OF MARINE FINFISH AQUACULTURE IN THE ASIA-PACIFIC REGION** Michael A. Rimmer
1450	**ESTIMATION OF CERTAIN GENETIC PARAMETERS ON GOLDEN *Mahseer tor putitora* (HAM.)** Jeena N S, Gopal Krishna*	**IMMUNOMODULATORY AND ANTIBACTERIAL ACTIVITY OF *Eclipta alba* LEAF EXTRACTS IN *Oreochromis mossambicus*** D. Christy Bapita*, M. Divya Gnaneswari, R. Dinakaran Michael	**ENVIRONMENTAL TRENDS AND CONSTRAINTS IN MARICULTURE DEVELOPMENT IN THE ASIA-PACIFIC REGION** Michael Phillips
1510	**GENETIC IMPROVEMENT STUDIES IN COMMON CARP *Cyprinus carpio*** Y. Basavaraju*, Graham C. Mair, S. Pradeep Kumar, H. M. Mohan Kumar, David J. Penman.	**EFFECT OF *Solanum trilobatum* LEAF EXTRACTS ON THE BACTERIAL PATHOGENS AND IMMUNE RESPONSE OF *Oreochromis mossambicus*** M. Divya Gnaneswari*, D. Christy Bapita, R. Dinakaran Michael	**HEALTH MANAGEMENT PRACTICES IN ASIAN MARICULTURE – CURRENT STATUS AND CHALLENGES** Zilong Tan*, Luc Grisez
1530	**SELECTION AND INTRASPECIFIC HYBRIDS IN RED SEA BREAM *Pagrus major* PART I: EFFECTS ON GROWTH PERFORMANCE** C. H. Noh*, Sung-Yong Oh, Y. S. Jang, K. P. Hong, H Jung Choi, Y. J. Park, J. G. Myoung, Jong-Man Kim	**EFFICACY OF SANOSIL AS AN ANTIBACTERIAL IN FRESHWATER PRAWN FARMING** K. Pani Prasad*, Nitin Rathod, S.C. Mukherjee	**ESCAPES OF FARMED FISH: ECOLOGICAL AND GENETIC IMPACTS ON NATURAL POPULATIONS AND HOW TO MANAGE THEM** Kai Lorenzen
1550	**TEA BREAK**		
1620	CHAIR : Mariana Nor Shamsudin **PART II: FEED UTILIZATION OF OFFSPRING FROM SELECTED KOREAN STRAIN, CULTURED JAPANESE STRAIN AND THEIR INTRASPECIFIC HYBRID OF RED SEA BREAM, *Pagrus major*** Sung-Yong Oh*, Choong Hwan Noh, Kyung Pyo Hong, Jong-Man Kim	CHAIR : R. Dinakaran Michael and Sohrab Akbari **ETHNOBOTANICALS AGAINST VIBRIOSIS** Florenda P. Española*, Ida G. Pahila	CHAIR : Michael Phillips **MARICULTURE IN THE PACIFIC** Ben Ponia
1640	**GENETIC ASSESSMENT AND MANAGEMENT OF CHINESE CARP STOCKS IN BANGLADESH** M.G. Hussain*, M.A. Sattar, T.K. Das, A. E. Gilmour, M.S. Islam, A.H.M. Kohinoor, M.A. Mazid, M.Y. Mia, M.A. Rahman, J. B. Taggart, David J. Penman, Brendan J. McAndrew	**THE HISTOLOGY, MORPHOGENESIS AND ULTRASTRUCTURE OF INCLUSIONS CONTAINING RICKETTSIA- LIKE ORGANISMS FROM THE OYSTER *Crassostrea ariakensis* GOULD** Jingfeng Sun, Xinzhong Wu*	**SALMON FARMING, A GLOBAL SUCCESS STORY – WITH FOCUS ON THE IMPACT OF VACCINES ON THE NORWEGIAN INDUSTRY** Alistair Brown
1700		FINANCE BOUND REHABILITATION PROGRAM TO REDUCE THE RISK OF WHITE SPOT VIRUS INFECTIONS IN MEDIUM SCALE SHRIMP FARMS OF SRI LANKA J.M.P.K. Jayasinghe*, N. Orlina	**ECONOMIC ASPECTS OF MARINE FISH CULTURE IN THE ASIA-PACIFIC REGION** Sih-Yang Sim
1720		**IRIDOVIRUS ISOLATED FROM DISEASED SEA BASS *Lates calcarifer* AND RED DRUM *Sciaenops ocellatus* CAUSING MASS MORTALITY IN MALAYSIA** Norihisa Oseko*, Chuah Toh Thye, V. Palanisamy, Yukio Maeno, Jun Kurita	**INDUSTRY STANDARDS FOR RESPONSIBLE FISHING PRACTICES: THE LIVE REEF FOOD FISH TRADE IN SOUTHEAST ASIA AND THE PACIFIC** Peter Scott, Geoffrey Muldoon*

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		Pekaka Restoring & Sustaining Capture Fisheries (Managemant Measures, Stock Delineation)		**Merbah 1** Global Symposium on Gender & Fisheries		**Merbah 2** Fisheries Co-Management
0830	**KEYNOTE 2: DR. MAHFUZUDDIN AHMED** (GRAND BALLROOM)					
0930	**TEA BREAK** (GRAND BALLROOM FOYER)					
1000	CHAIR : S.D. Tripathi and Kai Lorenzen	**POPULATION DYNAMICS AND SOME ASPECTS OF BIOLOGY OF HILSA *Tenualosa ilisha* IN BANGLADESH AND ITS MANAGEMENT STRATEGIES** Rahman Md. Anisur	CHAIR : Katia Frangoudes	**NO SHELLS, NO LANGALANGA: HARD TIMES IN MALAITA, SOLOMON ISLANDS** Kristina Fidali-Hickie*, Cherie Whippey-Morris	CHAIR : Kuperan Viswanathan	**CURRENT DECENTRALIZATION OF FISHERIES MANAGEMENT IN INDONESIA** Arif Satria*, Yoshiaki Matsuda
1020		**STATUS AND MANAGEMENT OF FISHERIES IN THE SUNDARBAN MANGROVES OF BANGLADESH** Md. Emdadul Haque*, Mike Elliott		**SUSTAINABLE AQUACULTURE DEVELOPMENT: IMPACTS ON SOCIAL LIVELIHOOD OF ETHNIC MINORITIES IN NORTHERN VIETNAM WITH EMPHASIS ON GENDER** Md.Ghulam Kibria*, Raymon Van Anrooy, Runia Mowla		**MONEY MATTERS: CREDIT AND SAVINGS AS IMPORTANT ELEMENTS OF FISHERIES MANAGEMENT** Nguyen Thi Bich*, Wolf D. Hartmann
1040		**USE OF INDIGENOUS TECHNICAL KNOWLEDGE IN INDIAN FISHERIES** A.A. Goswami*, B.K. Chand, P.K. Mukhopadhay, P. Biswas		**GENDER AND COASTAL ZONE BIODIVERSITY** Krishna Srinath		**MARKETING AS AN ESSENTIAL FUNCTION IN FISHERIES CO-MANAGEMENT: THE CASES OF HUAY LUANG (THAILAND) AND NAM HOUM (LAO PDR)** Sommano Phounsavath*, Kanokporn Deeburee, Wolf D. Hartmann
1100		**FISHERIES MANAGEMENT OF BONY FISHES IN THE IRANIAN WATERS OF THE CASPIAN SEA** Shahram Abdolmalaki		**ROLE OF WOMEN AND CHILDREN IN THE MANAGEMENT OF MUSSEL AND OYSTER FARMS IN THE COASTAL AREAS OF CAVITE, PHILIPPINES** Jimmy T. Masagca		**MEDIA - A POWERFUL TOOL TO CREATE AWARENESS IN THE COMMUNITY FOR FISHERIES RESOURCE DEVELOPMENT OR, AN AGENT IN CREATING MASS AWARENESS IN COMMUNITY BASED FISHERIES MANAGEMENT PROJECT** Ms. Nargis Akter
1120		**COMMUNITY BASED FISHERIES MANAGEMENT IN THE COASTAL AREA OF BANGLADESH: A CASE STUDY** Runia Mowla*, Md.Ghulam Kibria		**SUBSISTENCE, SURPLUS AND SEAWEED: WOMEN'S FISHING AND MARINE WORK IN KIRIBATI** Jean Mitchell		**COASTAL AREA MANAGEMENT BY LOCAL ORGANIZATIONS: HOW PEOPLE PARTICIPATE IN THEIR COMMUNITY DEVELOPMENT, CASE STUDY APPROACH IN THAILAND** Wantana Chenkitkosol*, Masahiro Yamao
1140		**BIOLOGY OF *Gudusia chapra* IN A COMMUNITY MANAGED NATURAL RESERVOIR IN BANGLADESH AND THE IMPACTS OF THE FISH ON THE NUTRITION OF THE ADJACENT POOR** Md. Mahfuzul Haque*, Md. Anisur Rahman		**AN INTEGRATED APPROACH ON GENDER ISSUES OF FISHERIES PROJECT IN COASTAL AREA OF BANGLADESH: PROBLEMS AND CHALLENGES** Runia Mowla*, Md.Ghulam Kibria		**COMMUNICATION PLANNING FOR PARTICIPATORY MANAGEMENT OF FISHERIES CONFLICTS IN CAMBODIA AND INDIA** Kuperan Viswanathan, Christopher Garforth, Nerissa Salayo*, Natarajan Ananth, Mak Sithirith
1200				**SUCCESSIVE INVOLVEMENT OF WOMEN: CLOSED WATER TO OPEN WATER FISHERIES** Anwara Begum Shelly*, Khan Muhammad Nurul Islam, Mohammed Alamgir		**COMMUNITY BASED ORGANIZATION: KEY FOR SUSTAINING CBFM APPROACH** Anwara Begum Shelly*, Md. Alamgir, K.M. Nurul Islam, Thomas Costa
1220				**"CONFINED MOBILITY: THE GENDERED IMPACTS OF AQUACULTURE DEVELOPMENT IN NORTHEASTERN THAILAND"** Leah Sullivan		**COMMUNITY MANAGED FISH SANCTUARIES: EXPERIENCE GAINED FROM CBFM-2 PROJECT IN BANGLADESH** Mohammod Ilyas*, Mohammod Sharoar Jahan Tareq, M. Anisul Islam
1240				**GENDER AND GENERATION: CRUCIAL ASPECTS OF LOCAL FISHERIES MANAGEMENT IN LELEPA, VANUATU** Jean Tarisesei, Irene Novaczek *		**THE INFLUENCE OF SOCIAL ACTORS ON COMMUNITY DEVELOPMENT: THE CASE OF A FISHING COMMUNITY IN SOUTHEASTERN PHILIPPINES** Ladylyn Lim Mangada*
1300	**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)					
1430			CHAIR : Irene Novaczek	**SEX AND NUTRITIONAL STATUS OF UNDER SEVEN CHILDREN IN THE COASTAL BARANGAYS IN BUENAVISTA, GUIMARAS** Alice Joan G. Ferrer	CHAIR : Kuperan Viswanathan	**LIVELIHOOD ANALYSIS OF THE SHRIMP PROCESSING WORKERS IN BANGLADESH** Md. Akteruzzaman
1450				**NUTRITIONAL STATUS AND SOCIO ECONOMIC EMPOWERMENT OF FISHERWOMEN IN COASTAL ECO-SYSTEM OF ANDHRA PRADESH, KARNATAKA, KERALA & TAMILNADU** Vijaya Khader		**PARTICIPATORY MONITORING OF TRENDS IN YIELD – DATA COLLECTION AND SHARING OF WHAT FOR WHAT?** Sompanh Chanpengxay*, Malasri Khumsri, Chhoun Kimchhea, Kanokpom Deeburee, Trung Ha Phuong, Wolf D. Hartmann
1510				**INTEGRATING THE GENDER PERSPECTIVE IN NUTRITION AND OCCUPATIONAL HEALTH IN FISHERIES SECTOR** Arpita Sharma*, R.S. Biradar, S.C. Mukherjee		**ECONOMICS OF FISHERIES CO-MANAGEMENT: HOW MUCH DOES IT COST, AND HOW TO PAY FOR IT?** Trung Ha Phuong*, Sommano Phounsavath, Wolf D. Hartmann
1530				**A STUDY ON WOMEN'S INVOLVEMENT IN PROCESSING AND GLOBALIZATION IN FISHERIES AND AQUACULTURE IN TAIWAN** Nai-Hsien Chao*, Meng-Hsien Chen, Yu-Huei Chen		**COMMUNITY-BASED MONITORING OF A SEAHORSE FISHERY USING FISHER LOG BOOKS** B.G. Giles, D. McCorry*, A.M. Torrechilla, J.A. Erediano, A.C.J. Vincent
1550	**TEA BREAK**					
1620	CHAIR : S.D. Tripathi and Kai Lorenzen	**ESTIMATING GENETIC DIFFERENTIATION AND CONNECTIVITY AT NESTED SPATIAL SCALES USING MICROSATELLITE MARKERS: EXAMPLES FROM TWO CORAL REEF ASSOCIATED SPECIES WITH CONTRASTING PELAGIC LARVAE DURATION AND ADULT BEHAVIOR** Ma. Carmen A. Ablan, Annadel Sarmiento Cabanban, Choulon Allen Chen, Amelia Goh Hui Xin	CHAIR : N.H. Chao	**WOMEN IN FISH BORDER TRADE: CASE OF FISH TRADE BETWEEN CAMBODIA AND THAILAND** Kyoko Kusakabe*, Prak Sereyvath, Ubolratana Suntornratana, Napaporn Sriputinibondh	CHAIR : Kuperan Viswanathan	**COMMUNITY PERCEPTIONS OF MARINE PROTECTED AREAS IN NORTHERN BOHOL, CENTRAL PHILIPPINES: MANAGEMENT, BENEFITS AND THREATS** D. McCorry*, J.A. Erediano, B. Giles, A.P. Blanco
1640		**GENETIC VARIATIONS OF THE SHRIMP *Penaeus chinensis* BASED ON RFLP OF MITOCHONDRIAL CONTROL REGION** Zhaoxia Cui*, Ka Hou Chu, In Kwon Jang		**UNDERUTILISED MEDICINAL MARINE PLANTS AS RESOURCES FOR RURAL WOMEN'S DEVELOPMENT IN THE SOUTH PACIFIC** Irene Novaczek		**THE EFFECT OF CO-MANAGEMENT PROCESSES ON ENFORCEMENT AND COMPLIANCE WITH FISHERIES REGULATION** Ida M. Siason
1700		**EFFECT OF INVASION OF *Mnemiopsis leidyi* ON PELAGIC FISHERY IN THE CASPIAN SEA** Farokh Parafkandeh Haghighi*		**THE INVOLVEMENT OF FEMALE LABOUR IN SEAFOOD PROCESSING IN SRI LANKA: IMPACT OF ORGANIZATIONAL FAIRNESS AND SUPERVISOR EVALUATION ON EMPLOYEE COMMITMENT** D.A.M. De Silva*, Masahiro Yamao		**IMPACT OF CBFM MICROFINANCE PROGRAM ON THE LIVELIHOODS OF FISHERS AND FISHERIES PRODUCTION IN BANGLADESH** Md. Ferdous Alam*, K. Kuperan Viswanathan
1720		**POPULATION STRUCTURE AND GENETIC LINKAGES AMONG *Caesio cuning* POPULATIONS IN MALAYSIA AND ADJACENT REGIONS** Amelia Goh Hui Xin*, Ma. Carmen Ablan, Shamala Palaniappan		**ALTERNATIVE LIVELIHOOD OPTIONS FOR FEMALE WORKERS IN SHRIMP PROCESSING INDUSTRIES OF BANGLADESH** Md. Nazmul Ahsan*, Asma Haque Airin, Mosammat Rowshan Ara		**MANAGEMENT OF FISH SANCTUARY: LEGAL ISSUES AND OPTIONS** Shakil Ahmed Khan

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		Murai 1 Inland Fisheries		**Murai 2** Socio-Economic Perspectives (Economic Policies & Institutions, WTO & Globalization, Market & Marketing)
0830	**KEYNOTE 2: DR. MAHFUZUDDIN AHMED** (GRAND BALLROOM)			
0930	**TEA BREAK** (GRAND BALLROOM FOYER)			
1000	**CHAIR** : Christopher Barlow	**CAMBODIAN FRESHWATER FISHERIES: AN OVERVIEW** Eric Baran*	**CHAIR** : Frazer McGilvray	**SOCIO-ECONOMIC CHARACTERIZATION OF INLAND FISH FARMERS OF KARNATAKA, INDIA: A CASE STUDY** Y. Basavaraju, Y.S. Arun Kumar*, Siddagangaiah, D.J. Penman, G.C. Mair
1020		**CATCH MONITORING FOR FISHERIES ASSESSMENT IN THE SONGKHRAM RIVER, UPPER NORTHEAST THAILAND** Ubolratana Suntornratana*, Anupong Sanitchon, Kent G. Hortle		**RESOURCE ALLOCATION EFFICIENCY OF THE CARP-FRESHWATER PRAWN *Macrobrachium rosenbergii* CULTURE FARMERS OF BANGLADESH** Md. Ferdous Alam*, Khandokar M. Shameem Kamal
1040		**MARKETING INFRASTRUCTURE, DISTRIBUTION CHANNELS AND TRADE PATTERN OF INLAND FISHERIES RESOURCES IN CAMBODIA: AN EXPLORATORY STUDY** Mohammed A. Rab*, Hap Navy, Seng Leang, Keang Seng, Mahfuzuddin Ahmed		**IMPACT OF THE SUPREME COURT JUDGEMENT ON SHRIMP FARMING IN INDIA** C. Vasudevappa*, Y.S. Arun Kumar, Y. Basavaraju, D. Seenappa, Denis Bailly
1100		**RESERVOIR FISHERIES OF SRI LANKA: PRESENT STATUS AND FUTURE STRATEGIES FOR MANAGEMENT** Upali S. Amarasinghe		**IMPACT ANALYSIS OF FISH TRADE LIBERALIZATION ON INCOME AND INCOME DISTRIBUTION IN THE PHILIPPINES** Raymundo P. Addun
1120		**SPATIAL AND TEMPORAL VARIATIONS IN FISH ASSEMBLAGES OF AN ARID ZONE FLOODPLAIN RIVER, COOPER CREEK, AUSTRALIA: IMPLICATIONS FOR ENVIRONMENTAL FLOWS** Angela Arthington*, Steve Balcombe		
1140		**SOCIOECONOMICS AND VALUES OF AQUATIC RESOURCES IN CAMBODIA: RESULTS FROM A SAMPLE SURVEY OF GREAT LAKE TONLE SAP AND MEKONG BASSAC RIVERS** Mohammed A. Rab*, Hap Navy, Mahfuzuddin Ahmed		
1200		**LESSONS LEARNT FROM A ONE YEAR TRIAL OF OPENING THE SLUICE GATES ON A DAM OF THE MUN RIVER (A TRIBUTARY OF THE MEKONG) IN THAILAND –THE FISHERIES VIEWPOINT** Tuantong Jutagate*, Chaiwut Grudphan, Thanatip Lamkom, Kanjana Payooha, Praneet Ngamsnae		
1220		**FISH MIGRATIONS IN THE MUN RIVER, A MEKONG TRIBUTARY IN THAILAND, WITH SPECIAL REFERENCE TO *Morulius chrysophekadion* AND *Helicophagus waandersi*** Tuantong Jutagate*, Pratak Tabthipwon, Sena S. De Silva		
1300	**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)			
1430	**CHAIR** : Christopher Barlow	**BENTHIC FAUNA IN THE MUN RIVER AND ITS TRIBUTARIES DURING THE OPENING OF THE SLUICE GATES OF THE PAKMUN DAM** Kanjana Payooha,* Praneet Ngamsnae, Chaiwut Grudphan, Thanatip Lamkom, Tuantong Jutagate	**CHAIR** : Mahfuzuddin Ahmed	**AN ENQUIRY INTO THE CONTRIBUTION OF THE FISH MARKETING AND DISTRIBUTION SYSTEM TO ECONOMIC INDICATORS IN THE KHULNA CITY OF BANGLADESH** Khairul Azam*, Mohammad Nazmul Ahsan, Andrew Palfreman, Alan Marriot
1450		**MAADEVALAYAL – UNIQUE FISHING METHOD IN VALAPATANAM RIVER** M.P. Remesan, A. Ramachandran*		**THE SUSTAINABLE LIVELIHOODS APPROACH OF FRESHWATER PRAWN MARKETING SYSTEMS IN BANGLADESH** Nesar Ahmed*, Taposhi Mariam Begum, Shohidul Islam Akandha and Sushmita Rahman
1510		**ESTIMATING CONSUMPTION OF FISH AND OTHER AQUATIC ANIMALS IN THE MEKONG BASIN: A COMPARISON OF INTERVIEW AND MEASUREMENT METHODS** Joseph G. Garrison*, Kent G. Hortle, Douangkham Singhanouvong, Lam Thanh Pham, Wirawan Rayan, Sokanyn Mao		**IMPROVING UNDERSTANDING OF MARKETING INTERACTIONS AND THEIR IMPACT UPON THE POOR: A CASE STUDY OF SMALL SCALE AQUACULTURE IN NORTHWEST BANGLADESH** Golam Faruque*, David C. Little, James A. Young, Madan M. Dey
1530		**STATUS OF KATHA (FISH AGGREGATING DEVICE) FISHERY IN THE RIVER TITAS OF BRAHMANBARIA, BANGLADESH** M.G. Mustafa*, Mahbubur Rahman Khan, K. Kuperan Viswanathan		**QUALITY OF SHRIMP IN THE DISTRIBUTION CHANNEL: AN APPROACH IN IMPROVING THE LIVELIHOOD OF FISHER COMMUNITY** K. Azam*, M.Z. Basher
1550	**TEA BREAK**			
1620				**SHIFTING CENTRE OF GRAVITY? DESTINATION AND PRODUCT DIVERSIFICATION IN SOUTH ASIAN SEAFOOD EXPORTS** D.A.M. De Silva*, Masahiro Yamao
1640				**EVALUATING RURAL CONSUMER PREFERENCES FOR INLAND FISH AND ITS SUBSTITUTES IN THE DRY-ZONE OF SRI LANKA USING PARTICIPATORY RANKING AND SCORING TECHNIQUES** F.J. Murray*, D.C. Little, Y. Naveratne

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		Grand Ballroom 1 Advances in Shrimp Biotechnology 2 (Viral Pathogens, Phylogeny & Epiderm)		**Grand Ballroom 2** Understanding Aquaculture Resources (Fish & Invertebrate Biology, Conservation of Biodiversity)		**Grand Ballroom 3** Increasing Aquaculture Productivity (Nutrition & Feed Management, Breeding & Larviculture)
0830				**KEYNOTE 3: MR. ROLF WILLMANN**		
0930				**TEA BREAK**		
1000	**CHAIR** : Chu-Fang Lo and Anchalee Tassanakajon	**MOLECULAR CHARACTERIZATION OF SHRIMP WHITE SPOT SYNDROME VIRUS (WSSV) BY GENOMIC AND PROTEOMIC APPROACHES** Chu-Fang Lo*, Guang-Hsiung Kou	**CHAIR** : Kwang-Sik Choi	**TAXONOMIC STATUS OF MUD CRAB *Scylla* sp. IN BANGLADESH** Abu Tweb Abu Ahmed*, Mohammed Iqbal, Mohammad Mamun Chowdhury	**CHAIR** : Wing-Keong Ng and Houng-Yung Chen	**EFFECTS OF DIETARY LIPID LEVELS AND SOURCES IN ISOENERGETIC DIETS ON GROWTH, BODY COMPOSITION AND TISSUE FATTY ACID COMPOSITION IN JUVENILE *Barbodes altus*** Adrian Elangovan
1020				**SELF-FERTILIZING MANGROVE KILLIFISH *Rivulus marmoratus* AS A MODEL FISH FOR MARINE AQUACULTURE: BIOLOGY OF TWO CLONAL STRAINS** Maria Vivian Camacho Grageda*, Yoshitaka Sakakura, Masako Minamimoto, Atsushi Hagiwara		**FEEDING PERIODICITY, GUT EVACUATION RATE AND DAILY RATION OF FINGERLINGS OF MRIGAL *Cirrhinus mrigala* (HAMILTON)** T.S. Annappaswamy*, H.R.V. Reddy, T.S. Nagesh
1040		**WHITE SPOT SYNDROME VIRUS AND CRAYFISH: REPLICATION IN A CELL CULTURE AND HOST INTERACTION** Pikul Jiravanichpaisal, Hai Peng Liu, Lage Cerenius, Kenneth Söderhäll, Irene Söderhäll		**SOME ASPECTS OF THE BIOLOGY AND CONSERVATION OF *Horabagrus brachysoma* AN ENDANGERED BAGRID CATFISH FROM VEMBANAD LAKE, INDIA** G. Prasad*, Rajeev Raghavan, N. Sreeraj		**FATTY ACID PROFILE IN *Perna viridis* FROM SEBATU, MELAKA** S. Ramli, B.A.G. Idris, H. Omar, N.A. Aziz, Fawzi Zakaria*, A. Supian
1100		**GENOMIC AND PROTEOMIC ANALYSIS OF 39 STRUCTURAL PROTEINS OF SHRIMP WHITE SPOT SYNDROME VIRUS** Jyh-Ming Tsai*, Han-Ching Wang, Jiann-Horng Leu, He-Hsuan Hsiao, Andrew H.-J. Wang, Guang-Hsiung Kou, Chu-Fang Lo		**PRELIMINARY BIOLOGY STUDY OF THAI TUNICATE *Ecteinascidia thurstoni* FOR AQUACULTURE** P. Koeysin, S. Chavanich*, K. Suwanborirux, V. Viyakarn, S. Piyatiratitivorakul, P. Menasveta		**ELEVATED DIETARY LEVELS OF TRF, TOCOTRIENOLS-RICH FRACTION, EXTRACTED FROM CRUDE PALM OIL, AFFECT VITAMIN E STATUS AND OXIDATIVE STABILITY OF TILAPIA TISSUES** Y. Wang*, K.H. Yuen, W.K. Ng
1120		**VP664, THE LARGEST VIRUS STRUCTURAL PROTEIN EVER FOUND, IS THE MAJOR NUCLEOCAPSID PROTEIN OF WSSV** Jiann-Horng Leu*, Jyh-Ming Tsai, Han-Ching Wang, Andrew H.-J. Wang, Chung-Hsiung Wang, Guang-Hsiung Kou, Chu-Fang Lo		**THE DISTRIBUTION OF ECHINODERMATA AT MUSSEL CULTURE AREA IN SEBATU, MALACCA** M.Z. Ali*, M.A. Hossain, M.A. Mazid		**EVALUATION OF MIXED FEEDING SCHEDULES WITH VARYING DIETARY PROTEIN CONTENT ON THE GROWTH PERFORMANCE AND REDUCTION OF COST OF PRODUCTION FOR PANGAS, *Pangus hypophthalmus*, WITH SIVER CARP, *Hypopthalmicthys molitix*, IN FARMERS PONDS** M.Z. Ali*, M.A. Hossain, M.A. Mazid
1140		**USE OF THE YEAST-2-HYBRID SYSTEM TO ISOLATE OF SHRIMP PROTEINS THAT INTERACT WITH TAURA SYNDROME VIRAL CAPSID PROTEIN** Saengchan Senapin*, Jongrak Kittiworakarn, Timothy W. Flegel		**SEASONAL CHANGES IN Perkinsus AND Cercaria INFECTIONS IN THE MANILA CLAM *Ruditapes philippinarum* FROM JEJU, KOREA** Thao T.T. Ngo*, Kwang-Sik Choi		**EVALUATION OF THE EFFECT OF DIETARY VITAMIN C, E AND ZINC SUPPLEMENTATION ON REPRODUCTIVE PERFORMANCE OF NILE TILAPIA *Oreochromis niloticus*** M. Gammanpila*, A. Yakupitiyage, A.N. Bart
1200		**HIGHLY EXPRESSED GENES IN LYMPHOID ORGAN OF HEALTHY AND *Vibrio harveyi* CHALLENGED SHRIMP *Penaeus monodon*** Siriporn Pongsomboon*, Ratree Wongpanya, Sureerat Tang, Chidchanok Lursinsap, Kasemsant Kuphanumat, Anchalee Tassanakajon		**ECHINODERM ASSOCIATED WITH CULTURED MUSSEL** S. Ramli, H. Omar, N.A. Aziz, A.R. Ismail, B.A.G. Idris, M.F. Osman		**ESTIMATION OF IN VITRO PROTEIN DIGESTIBILITY AND INHIBITORY EFFECTS OF DIFFERENT FEED AND INGREDIENTS ON PROTEASE ACTIVITY OF FRESH WATER GIANT PRAWN *Macrobrachium rosenbergii* (DE MAN)** Md. Ayaz Hasan Chisty*, Roshada Hashim, Alexander Chong
1220		**CLONING AND EXPRESSION OF YHV GLYCOPROTEIN GENE GP116 USING THE BACULOVIRUS EXPRESSION APPROACH** Nusra Sittidilokratna*, Vichai Boonsaeng, Peter J. Walker		**OCCURRENCE OF PARASITES, ESPECIALLY *Marteilioides chungmuensis* IN PACIFIC OYSTERS, *Crassostrea gigas*** Thao T.T. Ngo*, Kwang-Sik Choi		**THE EFFECT OF MIXED FEEDING SCHEDULES ON THE DAILY SPECIFIC ACTIVITY OF PROTEASES IN STOMACH AND INTESTINE OF AFRICAN CATFISH *Clarias gariepinus*** Mohammed AL-Dohail*, Roshada Hashim
1240		**DEVELOPMENT OF LOW COST-DETECTION METHODS FOR ON-FARM SCREENING OF GILL-ASSOCIATED VIRUS (GAV) LOAD** James Munro*, Leigh Owens		**HAEMATOLOGICAL RESPONSE IN ECOPHYSIOLOGICAL ADAPTATIONS IN SOME FRESH WATER FISHES-CONCEPT OF ADAPTATIONAL ANAEMIA** B.N. Pandey		
1300				**LUNCH & POSTER VIEWING** (MATAHARI BALLROOM)		
1430	**CHAIR** : Chu-Fang Lo and Anchalee Tassanakajon	**DETECTION OF WHITE SPOT SYNDROME VIRUS AND YELLOW HEAD VIRUS IN SHRIMP BY LOOP-MEDIATED ISOTHERMAL AMPLIFICATION** Tohru Mekata*, Tomoya Kono, Ram Savan, Terutoyo Yoshida, Masahiro Sakai, Jiraporn Kasornchandra, Toshiaki Itami	**CHAIR** : Abu Tweb Abu Ahmed and Annie Cristianus	**GROWTH AND PRODUCTION OF LABORATORY CULTURED CYCLOPOID COPEPOD *Apocyclops dengizicus* (LEPESCHKIN, 1900) AT DIFFERENT SALINITY LEVELS** Omidvar Farhadian*, Fatimah M. Yusoff, Aziz Arshad, Perumal Kuppan		
1450		**PERSISTENT VIRAL INFECTION (VIRAL ACCOMMODATION) REDUCES THE SEVERITY OF DISEASE IN CRUSTACEANS AND OTHER ARTHROPODS** T.W. Flegel		**ASSESSMENT OF FISH FAUNA IN BEEL KHUKSHIA OF JESSORE, BANGLADESH** J. K. Saha*, M.R. Hasan		
1510		**THE INTERACTION OF AN OSMOLYTE, BETAINE AND SHOCK PROTEINS IN VIRUS INFECTED *Penaeus monodon*** Leigh Owens*, Laurence Liessmann		**STUDY ON PATERNAL GERMPLASM REPOSITORY OF SELECTED INDIGENOUS FRESHWATER FISHES IN TAIWAN** Nai-Hsien Chao*, Shih-Ya Wang, Fu-Ning Tsai		
1530		**ISOLATION AND CHARACTERIZATION OF GENES INVOLVED IN APOPTOSIS FROM WSSV-INFECTED SHRIMP *Penaeus monodon*** Pukkakul Sungsuriya*, Jiraporn Rojtinnakorn, Saengchan Senapin, Kallaya Sritunyalucksana, Timothy W. Flegel		**STUDY ON PIVOTAL TEMPERATURE OF GREEN TURTLE *Chelonia mydas* ON THE EAST COAST OF PENINSULAR MALAYSIA** S. Abdullah*, I. Kamaruddin, I. Mazlan, T. Zulkifli		
1550				**TEA BREAK**		
1620	**CHAIR** : Peter Walker and Just Vlak	**CHALLENGING SUCCESSIVE MOSQUITO GENERATIONS WITH A DENSONUCLEOSIS VIRUS YIELDS PERSISTENT, INNOCUOUS INFECTIONS AND PROGRESSIVE IMPROVEMENTS IN SURVIVAL** Songsak Roekring*, Pattamaporn Kittayapong, Siriporn Sriurairatana, T.W. Flegel	**CHAIR** : Abu Tweb Abu Ahmed and Annie Cristianus	**TWO SPECIES OF HORSESHOE CRABS, THE *Carcinoscorpius rotundicauda* AND *Tachypleus gigas* IN PENINSULAR MALAYSIA** A. Christianus, C.K. Ng, P. Hajeb, C.R. Saad	**CHAIR** : Ambok B. Abol-Munafi	**BREEDING CAPABILITY OF THE HYBRID CATFISH *Clarias macrocephalus* X *C. gariepinus* IN CAPTIVE CONDITION** Ambok Bolong Abol-Munafi, Pham Thanh Liem*, Mohd Azmi Ambak
1640		**MOLECULAR GENETICS AND EPIDEMIOLOGY OF WHITE SPOT SYNDROME VIRUS OF SHRIMP** Just M. Vlak		**MIGRATION AND BREEDING OF FRESHWATER FISHES IN THE BEELS OF EASTERN BANGLADESH** K.K.U. Ahmed*, S.U. Ahmed, M.A. Mazid, K.R. Hasan		**INDUCED BREEDING AND LARVAE REARING OF *Ompok pabda* (HAMILTON)** Fazlul Awal Mollah
1700		**PHYLOGENETIC ANALYSIS AND EVIDENCE OF GENETIC RECOMBINATION AMONG SIX GENOTYPES OF YELLOW HEAD COMPLEX VIRUSES FROM *Penaeus monodon*** Priyanjalie Wijegoonawardane, Jeff A. Cowley, Wansika Kiatpathomchai, Linda Nielsen, Peter J. Walker		**THREATENED FISHES OF RIVERS OF KERALA (SOUTH INDIA) WITH SPECIAL REFERENCE TO ENDEMISM, DISTRIBUTION AND STOCK SIZE** K.V. Radhakrishnan, B. Madhusoodana Kurup		**EFFECT OF TRANSPORTATION STRESS ON THE FEEDING OF MAJOR CARP HATCHLINGS IN A NURSERY POND OF BANGLADESH** M. Niamul Naser*, Pronob K. Mozumder
1720		**PREVALENCE OF TAURA SYNDROME VIRUS (TSV) AND INFECTIOUS HYPODERMAL AND HAEMATOPOIETIC NECROSIS VIRUS (IHHNV) IN *Penaeus vannamei* AND OTHER AQUATIC SPECIES NATIVE TO THAILAND** Jareeporn Ruangsri*, Suphada Kiriratnikom, Nopadol Sukrakanchana, Supatra Arunrat, Nirut Sukkasame, Tanawut Klowkliang, Jiraporn Kasornchandra, Kidchakan Supamattaya		**CONSERVING ASIAN BIODIVERSITY: IMPOSSIBLE WITHOUT INFORMATION SYSTEMS?** Boris Fabres*, Rodolfo Reyes Jr., Eli Agbayani, Josephine Rius		**EFFECT OF HOLDING TEMPERATURE AND LIGHT REGIME ON REPRODUCTIVE PERFORMANCE OF RAINBOW TROUT *Oncorhynchus mykiss* IN THAILAND** Prasan Pornsoping*, Gomut Unsrisong, Therdchai Vearasilp, Gabriele Hörstgen-Schwark
1740				**CONSERVATION OF SMALL INDI GENOUS SPECIES (SIS) IN FLOOD-PLAIN ECOSYSTEM, BANGLADESH** Sadeka Halim*, Md. Kawser Ahmed, Md. Akhteruzzaman		

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		Serindit Increasing Aquaculture Productivity (Grow-out Technology)		**Tekukur** Promoting Environment-Friendly Management (Reducing Risks of Diseases)		**Bayan** Advances in Seaweeds Cultivation and Utilization in Asia
0830		**KEYNOTE 3: MR. ROLF WILLMANN** (GRAND BALLROOM)				
0930		**TEA BREAK** (GRAND BALLROOM FOYER)				
1000	CHAIR : Modadugu Gupta and Yang Yi	**MUD CRAB *Scylla serrata* FATTENING IN BAMBOO CAGES IN BANGLADESH COASTAL WATERS** Mohammad Zafar	CHAIR : Mohamed Shariff Mohamed Din and Leong Tak Seng	**ENVIRONMENT FRIENDLY MANAGEMENT OF ARGULOSIS IN BROOD CARP PONDS** Abu Tweb Abu Ahmed*, Mohammad Mamun Chowdhury	CHAIR : Phang Siew Moi and Masao Ohno	**DEVELOPMENT OF THE SEAWEED CULTIVATION AND INDUSTRY IN JAPAN** Masao Ohno
1020		**COMMUNITY BASED MOLLUSC CULTURE IN BANGLADESH COAST: AN ALTERNATIVE INCOME GENERATING OPTIONS FOR THE POOR** Md. Shahadat Hossain, A. S. M. Saifullah, Md. Ataur Rahman		**PRE-DISPOSING FACTORS ASSOCIATED WITH OUTBREAK OF STREPTOCOCCAL INFECTION IN FLOATING CAGE-CULTURE RED TILAPIA IN RESERVOIRS** A. Siti-Zahrah, S. Misri, B. Padilah, R. Zulkafli, B.C. Kua, A. Azila, R. Rimatulhana		
1040		**STATUS OF CAGE CULTURE IN LAO PDR** Somboon*, Sola Simmalavong, Bounthong Saphackdy, Lieng Khamsivilay		**MONOCLONAL ANTIBODIES SPECIFIC TO *Vibrio harveyi* 639** Wannipa Phianphak, Paisarn Sithigorngul, Sirirat Rengpipat		
1100		**A BIOECONOMIC EVALUATION OF TILAPIA MONOCULTURE AND POLYCULTURE WITH FRESHWATER PRAWN WITH AND WITHOUT PERIPHYTON SUBSTRATES** Md. Sharif Uddin*, Alize Farzana, Md. Abdul Wahab, Mst. Kaniz Fatema, Mohd. Ekram-Ul-Azim		**ECTOPARASITES AND BACTERIAL INFECTION IN CULTURED GOLDEN SNAPPER *Lutjanus johni* IN NORTHWEST MALAYSIA** Leong Tak Seng*, Cedric Komar, Annick Bolland, Luc Grisez, Zilong Tan		**SEAWEED INDUSTRY OF THE PHILIPPINES** AQ Hurtado, AT Critchley
1120 1130		**PERFORMANCE OF MUD CRAB *Scylla olivacea* CULTURE IN BAMBOO PENS AT DIFFERENT STOCKING DENSITIES FROM SOUTHWEST BANGLADESH** Dipak Kamal*, Md. Forhad Uddin		**PATHOGENICITY OF ALPHA-HAEMOLYTIC GROUP B *Streptococcus agalactiae* IN *Oreochromis niloticus*** Naraid Suanyuk*, Kidchakan Supamattaya		**SEAWEED INDUSTRY IN THAILAND** Anong Chirapart
1140		**AQUACULTURE IN LANDLOCKED STATES OF INDIA-AN APPRAISAL, CONSTRAINTS AND DEVELOPMENT STRATEGIES** Asha Dhawan		**OUTBREAKS OF KHV INFECTION IN COMMON CARP IN SUMATRA, INDONESIA** Kei Yuasa*, Novita Panigoro , Meliya Bahnan , Edy Barkat Kholidin , Isti Koesharyani, Kishio Hatai		
1200		**THE POTENTIAL OF SELF- RECRUITING SPECIES (SRS) IN AQUACULTURE FOR SUSTAINING THE LIVELIHOODS OF RURAL POOR IN BANGLADESH** M.A. Wahab*, Faruk-Ul-Islam, David C. Little		**EFFECT OF AN INTESTINAL BACTERIUM Bacillus circulens (PB7) SUPPLEMENTED IN THE FORMULATED DIETS ON GROWTH, NUTRITIONAL QUALITY AND IMMUNITY OF *Catla catla* (HAM.)** Partha Bandyopadhyay *, Shampa Patra, Bidhan C. Patra		**SEAWEEDS FROM MANADO BAY, INDONESIA** Grevo S. Gerung
1220 1230		**EFFECT OF ADDED SUBSTRATES ON THE PRODUCTION AND POPULATION CHARACTERISTICS OF *Macrobrachium rosenbergii*** K. Ranjeet, B. Madhusoodana Kurup		**IMPORTANT FISH DISEASES IN TROPICAL FRESHWATER AQUACULTURE** Kei Yuasa*, Meliya Bahnan, Novita Panigoro, Edy Barkat Kholidin, Kishio Hatai		**THE SEAWEED INDUSTRY IN SABAH, EAST MALAYSIA** Ahemad Sade
1240		**SUITABLE SPECIES COMPOSITION IN THE POLYCULTURE OF THAI PANGUS *Pangasius hypopthalamus* WITH CARPS AND PRAWN** Khandaker Anisul Huq*, Md. Sherazul Islam, Md. Anisur Rahman		**DIGENETIC BLOOD TREMATODES IN MALAYSIAN FISHES** Faizah Shaharom – Harrison		
1300		**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)				
1430	CHAIR : Gopinath Nagaraj	**CAGE CULTURE OF RAINBOW TROUT *Onchorynchus mykiss* IN STAGNANT WATER IN LAKE AND RESERVOIR** Jay Dev Bista*, Tek Bahadur Gurung, Suresh Kumar Wagle, Ganesh Bahadur Karki, Ram Prasad Dhakal	CHAIR : Faizah Shaharom-Harrison and Xinzhong Wu	**FIRST REPORT ON THE OCCURRENCE OF VIRAL NERVOUS NECROSIS IN *Lutjanus erythropterus* IN MALAYSIA** Chuah Toh-Thye*, Kua Beng-Chu		**SEAWEED RESOURCES FOR CULTIVATION AND UTILIZATION IN MALAYSIA** Christine A. Orosco (Siti Aishah Abdullah)*, Gan Ming Herng, Fong Chuen Far
1450 1500		**DOMESTICATION OF SAHAR *Tor putitora* AND ITS DEVELOPMENT IN THE HIMALAYAN KINGDOM OF NEPAL** Ash Kumar Rai*, Sadhu Ram Basnet, Arun Prasad Baidhya, Jay Dev Bista and Tek Bahadur Gurung		**ELECTROLYSIS: A STRATEGY TO CONTROL NON-BENEFICIAL ALGAL SPECIES IN SHRIMP GROW OUT SYSTEMS** R.G. Saman Wijesekara*, Nakao Nomura, Masatoshi Matsumura	CHAIR : Alan Critchley	**NEW TANK MARICULTURE SYSTEM OF SEAWEEDS USING DEEP SEAWATER IN JAPAN** Masanori Hiraoka*, Naohiro Oka
1510		**EFFECTS OF DIFFERENT CULTURE SYSTEM, DENSITY AND NUTRIENTS ON *Macrobrachium rosenbergii* PRODUCTION IN AN ARTIFICIAL INTEGRATED CULTURE SYSTEM** H. Khoda Bakhsh*, Alimon, A.R., Christianus, A., Khanif, M.Y., Aizam, Z. A., Rashid Shariff		**PROTECTION OF SEABASS *Lates calcarifer* AGAINST CRYPTOCARYONIASIS BY IMMUNIZATION WITH VARIOUS DOSES OF INFECTIOUS STAGES OF *Cryptocaryon irritans*** Kua Beng Chu		
1530		**COMPARATIVE STUDY WITH ON-FARM TRIALS OF ORGANIC & INORGANIC FERTILIZATION REGIMES ON CARP SPECIES IN TWO DIFFERENT AREAS OF BANGLADESH** Md. Abdur Rahman*, Prohlad Chandra Dey		**THE USE OF CLEANER WRASSE FOR CONTROL OF ECTOPARASITES IN MARICULTURE** Teoh Hong Peng, Faizah Shaharom-Harrison		**ADVANCE OF Porphyra AQUACULTURE IN CHINA** Peimin He
1550 1600		**TEA BREAK**				
1620 1630		**POLYCULTURE OF *Pangasius hypophthalmus* WITH INDIAN MAJOR CARPS FOR HIGHER FISH PRODUCTION** Md. Reaz Uddin Sarkar*, Saleha Khan, Md. Mahfuzul Haque	CHAIR : Faizah Shaharom-Harrison and Xinzhong Wu	**STUDY ON FISH DISEASE IN HATCHERY POND AND FISH CULTURE WITH LIVESTOCK IN OUDOMXAY PROVINCED** Somphouthone Phimmachak, Saleumphone Chanthavong, Somboun		**TEA BREAK**
1640				**DIAGNOSIS, PATHOLOGY AND TAXONOMY OF *Perkinsus* sp. ISOLATED FROM THE MANILA CLAM *Ruditapes philippinarum* IN KOREA** Kwang-Sik Choi*, Kyung-Il Park , Moonjae Cho, Philippe Soudant	CHAIR : Alan Critchley	**DISEASES IN CULTIVATED SEAWEEDS IN THE PHILIPPINES: IS IT AN ISSUE AMONG SEAWEED INDUSTRY PLAYERS?** Danilo B. Largo
1700				**GROWTH AND MORTALITY RATES OF TWO FRESHWATER FISH SPECIES IN DYALA RIVER, NEAR BAGHDAD** Abdulmotalib Jassim Al-Rudainy		**ECO-MANAGEMENT OF SEAWEED RESOURCES** Put O. Ang, Jr.
1720 1730				**COMPARISON BETWEEN MS222 AND EUGENOL AS SEDATIVE AND ANESTHETIC AGENTS IN SHRIMP *Penaeus indicus*** S. Akbari, A. Khajavi		

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		Pekaka Restoring & Sustaining Capture Fisheries (Stock Assessment)		**Merbah 1** Global Symposium on Gender & Fisheries		**Merbah 2** Fisheries Co-Management
0830		**KEYNOTE 3: MR. ROLF WILLMANN** (GRAND BALLROOM)				
0930		**TEA BREAK** (GRAND BALLROOM FOYER)				
1000	**CHAIR** : Syed Abdullah Syed Abdul Kadir	**SOUTH AND SOUTHEAST ASIAN SEAS: LINKING RESOURCE AND SOCIO-ECONOMIC ASSESSMENT WITH MANAGEMENT** Ilona Stobutzki*, Len Garces, Gerry Silvestre, Mahfuzuddin Ahmed	**CHAIR** : N.H. Chao	**WOMEN'S PARTICIPATION IN TRADITIONAL FISH PROCESSING: EXPERIENCE OF PROSHIKA UNDER CBFM IN VILLAGE DASPARA, KULIARCHAR IN BANGLADESH** Md. Abdur Rahman *, Sabuj Kumar Chowdhury	**CHAIR** : Kuperan Viswanathan	**FISHERIES MANAGEMENT AND LEGAL ASPECT OF CBFM** M. Iqbal Kabir
1020		**SPATIAL PATTERNS IN THE ASSEMBLAGE STRUCTURE AND TEMPORAL TRENDS IN SPECIES COMPOSITION OF DEMERSAL RESOURCES IN SOUTH AND SOUTHEAST ASIA: A PRELIMINARY ANALYSIS** Len R. Garces*, Ilona Stobutzki, Geronimo Silvestre, Alias Man, Abu Talib Ahmad		**SELLING FISH IN TARAWA, KIRIBATI** Maere Tekanene		**ANALYSIS OF KEY LIVELIHOOD CONSTRAINTS OF PRIMARY STAKEHOLDER GROUPS BY USING SL APPROACH AS A TOOL: EXPERIENCES OF CBFM-2 PROJECT IN BANGLADESH** Mohammod Sharoar Jahan Tareq*, Mohammod Ilyas, M. Anisul Islam
1040		**HISTORICAL CHANGES IN THE FISHERIES RESOURCES OF THE EAST COAST OF PENINSULAR MALAYSIA** Nurulhuda Ahmad Fatan*, Ilona Stobutzki, Len R. Garces, Abu Talib Ahmad	**CHAIR** : M.C. Nandeesha	**GENDER STRATIFICATION IN FISH PRODUCTION SYSTEMS: WOMEN DO HAVE ECONOMIC POWER** Marieta Banez-Sumagaysay*		**PAPD (PARTICIPATORY ACTION PLAN DEVELOPMENT) – A PARTICIPATORY TOOL FOR CONSENSUS BUILDING AMONG STAKEHOLDERS OF MULTI FUNCTIONAL WETLANDS: EXPERIENCES OF CBFM-2 PROJECT IN BANGLADESH** A. M. Islam, * M.M. Rahman, S. K. Chowhan
1100		**TAGGING OF *Litopenaeus vannamei* BY TAIL-CUTTING** I Chiu Liao, Eduardo M. Leaño		**GENDER STATUS IN INDIAN FISHERIES EDUCATION, RESEARCH AND DEVELOPMENT ORGANIZATIONS** M.C. Nandeesha		**CO-MANAGEMENT APPROACH IN PROJECT IMPLEMENTATION: EXPERIENCES OF CNRS (AN NGO) IN IMPLEMENTING FOUR SELECTED CO-MANAGEMENT PROJECTS IN BANGLADESH** Mohammod Sharoar Jahan Tareq*, M. Anisul Islam, M. Mokhlesur Rahman
1120		**MIGRATION PATTERN AND POPULATION DYNAMICS OF *Channa striata* IN THE RAINFED RICE FARMING LANDSCAPE OF NORTHEAST THAILAND** E. Amilhat*, K. Lorenzen		**GENDER MAINSTREAMING IN MEKONG FISHERIES: FROM POLICY TO PRACTICE** Napaporn Sriputinibondh*, Kaing Khim, Nguyen Thi Bich, Kanokporn Deeburee, Nouhak Liepvisay, Wolf D. Hartmann		**POLLUTION ISSUES AND ITS TREATMENTS IN CBFM-2 PROJECT** Md. Anwaruzzaman
1140		**POPULATION DYNAMICS *Penaeus semisulcatus* IN IRANIAN WATERS OF PERSIAN GULF** Shahram Ghassemi		**A STUDY OF WOMEN FISHERS EMPOWERMENT IN DIFFERENT LEVEL OF CO-MANAGEMENT PROCESSES (CMPS) (A CASE STUDY IN FISHING COMMUNITY IN PEMALANG AND DEMAK REGENCIES, CENTRAL JAVA – INDONESIA)** Indah Susilowati		**COMMUNITY FISHERIES MANAGEMENT IN CAMBODIA—CHALLENGES AND OPTIONS FOR SUSTAINABLE MANAGEMENT** Paul W. Namisi
1200		**FISH CATCH ASSESSMENT OF FLOODPLAIN FISHERIES IN BANGLADESH: A CASE STUDY OF MALJHEE-KANGSA FLOODPLAIN** Nesar Ahmed*, Sushmita Rahman, Taposhi Mariam Begum, Shohidul Islam Akandha	**CHAIR** : Meryl J. Williams	**RESPONDING GENDER AND DEVELOPMENT ISSUES IN COASTAL AREAS: LESSONS LEARNED FROM PANGANGAN ISLAND, CALAPE, BOHOL, PHILIPPINES** Joselito Francis A. Alcaria*, Chona M. Tura		
1220		**CULTURE-BASED FISHERIES IN NON-PERENNIAL RESERVOIRS OF SRI LANKA** W.M.H. Kelum Wijenayake*, U. Asanka D. Jayasinghe, J.A. Athula, K.B. Chandrani Pushpalatha, Upali S. Amarasinghe, Sena S. De Silva		**LOOKING FOR WOMEN IN PHILIPPINE FISHERIES POLICIES: RESEARCH TO DETERMINE ADVOCACY POINTS FOR FISHERIES** Jovelyn T. Cleofe		
1240		**THE EFFECT OF THE COMMERCIAL FISHING CLOSURE ON ABUNDANCE OF JUVENILE FISH STOCKS AT TOWRA POINT, BOTANY BAY, NSW, AUSTRALIA** Debashish Mazumder*, Neil Saintilan, Robert J. Williams		**EUROPEAN FISHERWOMEN CONTRIBUTION IN FISHERIES AND ITS LEGAL RECOGNITION** Katia Frangoudes		
1300		**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)				
1430	**CHAIR** : I Chiu Liao	**AGE AND SIZE COMPOSITIONS OF SOUTHERN BLUEFIN TUNA *Thunnus maccoyii* CAUGHT BY TAIWAN LONGLINE FISHERY IN THE INDIAN OCEAN** J.C. Shiao, Y.T. Lin, W.N. Tzeng*, S.K. Chang	**CHAIR** : Meryl J. Williams	**WOMEN PARTICIPATION IN FISHERIES ACTIVITIES IN MANIPUR VALLEY IN INDIA WITH TRADITIONAL FISH BASED BELIEFS AND CUSTOMS** S.D.Gurumayum, M.C.Nandeesha*		
1450		**DIRECTED FISHERIES FOR DOLPHINS AND DUGONG IN SABAH, EAST MALAYSIA: PAST AND PRESENT** Saifullah A. Jaaman, Yuhana U. Lah-Anyi, Graham J. Pierce		**WOMEN AND FISHERIES IN BANGLADESH: LEVEL OF INVOLVEMENT AND SCOPE FOR ENHANCEMENT** Md. Kawser Ahmed *, Sadeka Halim		
1510		**TAXONOMY AS A BOTTLENECK IN FISHERIES MANAGEMENT: A CASE STUDY FROM CAMBODIA** Eric Baran*, Chheng Phen		**VALUING LOCAL KNOWLEDGE IN THE CANADIAN ARCTIC: HOW THE INVOLVEMENT OF LOCAL PEOPLES RESULTS IN RELEVANT RESOURCE MANAGEMENT DECISIONS** Joanna Kafarowski *		
1530		**SATELLITE BASED FISHERY FORECASTING FOR THE BENEFIT OF COASTAL FISHERFOLK** V.N. Pillai				
1550		**TEA BREAK**				
1620	**CHAIR** : I Chiu Liao	**POPULATION PARAMETERS OF OYSTER *Crassosrea madrasensis* OF BANGLADESH COAST** S.M. Nurul Amin*, M.A. Halim	**CHAIR** : Stephen J. Hall	**DISCUSSION**		
1640		**MULTIVARIATE APPROACH: STATUS OF SMALL PELAGICS IN THE EAST COAST OF MALAYSIA (1976-98)** M. Shahab Uddin*, H.M. Ibrahim, M.A. Ambak, H. Yanagawa				
1700		**A MEAN WEIGHT AND MEAN LENGTH STUDY ON SPINY LOBSTER *Panulirus homarus*** Mohammad Mazloomi Arjagh				

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		Murai 1 Restocking & Stock Enhancement of Coastal Fisheries		Murai 2 Aquatic Ecosystem Health Management
0830		**KEYNOTE 3: MR. ROLF WILLMANN** (GRAND BALLROOM)		
0930		**TEA BREAK** (GRAND BALLROOM FOYER)		
1000	CHAIR : Neil Loneragan	**LESSONS LEARNED FROM 30 YEARS OF RESTOCKING AND STOCK ENHANCEMENT OF MARINE INVERTEBRATES** Johann D. Bell*, Peter C. Rothlisberg, John L. Munro, Neil R. Loneragan, Warwick J. Nash, Robert D. Ward, Neil L. Andrew	CHAIR : M. Munawar	**LINKAGES AND INTERACTIONS BETWEEN FISHERIES, AQUACULTURE, AQUATIC ECOSYSTEM HEALTH, HUMAN POVERTY / WEALTH AND HUMAN HEALTH** Ian Bryceson
1020				
1040 1045		**THE IMPORTANCE OF IDENTIFYING SPATIAL POPULATION STRUCTURE IN RESTOCKING AND ENHANCEMENT PROGRAMS** Robert D. Ward		**RECENT ENVIRONMENT DAMAGE AND WATER MANAGEMENT SYSTEMS OF SHRIMP CULTURE ON THE ANDAMAN SEA COAST, SOUTHERN THAILAND** Suwat Tanyaros
1100 1115				**FECAL CONTAMINATION IN OYSTER *Crassostrea iredalei* CULTURED IN SETIU LAGOON, TERENGGANU, SOUTH CHINA SEA** Law Ah Theem*, Neoh Seong Seng, Chin Kam Yew
1120		**A METAPOPULATION IN A LARGE PELAGIC FISH? STOCK STRUCTURE IN NORTHERN AUSTRALIAN NARROW-BARRED SPANISH MACKEREL, INDICATED BY GENETICS, OTOLITH ISOTOPE RATIOS AND PARASITES** R. C. Buckworth*, S. J. Newman, J. R. Ovenden, R. J. Lester, G. R. McPherson		**USE OF MOLECULAR MARKERS TO DETERMINE THE SPECIATION OF *Perkinsus* sp. COLLECTED FROM MANILA CLAMS *Ruditapes philippinarum* IN KOREA** Kyung-Il Park, Joong-Ki Park, Jehee Lee, Kwang-Sik Choi*
1140 1145				**PROBIOTICS: A BREAKTHROUGH IN AQUATIC HEALTH MANAGEMENT** Vaneet Inder Kaur
1200 1215		**POPULATION DYNAMICS OF FISHERIES STOCK ENHANCEMENT** Kai Lorenzen		**SURVEY ON BACTERIAL FLORA AND HEAVY METAL CONCENTRATIONS IN WILD OYSTER *Crassostrea iredalei* FROM SETIU WETLAND, MALAYSIA** Najiah Musa*, Lee Kok Leong, Nurul Fadzilah Abdullah, Ahmad Shamsudin Ahmad, Wan Bayani Wan Omar
1220		**MERITS OF RESTOCKING AND OTHER FORMS OF MANAGEMENT FOR RESTORING SEVERELY OVER-EXPLOITED FISHERIES FOR TROCHUS *Trochus niloticus* AND SANDFISH *Holothuria scabra*** Warwick J. Nash		**CATCH RATES AS AN INDICATOR OF ECOSYSTEM HEALTH AND EXPLOITATION STATUS IN THE SHRIMP FISHERY IN SOUTH VIETNAM** Dang van Thi*, Steen Christensen
1240				**IMPACT OF WHITE SPOT DISEASE ON SHRIMP CULTURE INDUSTRY IN SRI LANKA** A.S.L.E. Corea
1245		**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)		
1300 1415				**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)
1430 1445	CHAIR : Warwick Nash	**NO-TAKE-ZONES FOR RESTOCKING OF THE SEA CUCUMBER *Holothuria scabra* DEFINED THROUGH MODELLING OF MOVEMENT DYNAMICS** Steve Purcell	CHAIR : Ian Bryceson	**CHALLENGES AND THREATS TO THE ECOSYSTEM HEALTH AND SUSTAINABLE DEVELOPMENT: LESSONS FROM THE NORTH AMERICAN GREAT LAKES** M.Munawar*, N. E. Mandrak, H. MacIsaac, I.F. Munawar, R. Dermott
1450		**FISH HEALTH MANAGEMENT IN MARINE STOCKING PROGRAMMES** Devin M. Bartley*, Rohana Subasinghe		
1510 1515		**SUCCESSFUL STOCK ENHANCEMENT OF THE JAPANESE SCALLOP *Patinopecten yessoensis* IN HOKKAIDO** Nagashisa Uki		**EFFECT OF A RECLAMATION PROJECT ON NUTRIENT DISTRIBUTION IN ARIAKE SEA, JAPAN** Ichikawa Toshihiro*, Sato Masanori, Azuma Mikio
1530 1545		**TEA BREAK**		**ENVIRONMENTAL CAPACITY AND MANAGEMENT OF COASTAL SHRIMP CULTURE IN BANGLADESH** M. A. Rouf*, M. M. M. Islam, C. Rod, J. Hambrey
1550 1615				**TEA BREAK**
1620	CHAIR : Warwick Nash	**LESSONS LEARNED FROM JAPANESE MARINE FINFISH STOCK ENHANCEMENT PROGRAMS** Shuichi Kitada	CHAIR : Ian Bryceson	**STEPWISE REGRESSION ANALYSIS FOR DISSOLVED OXYGEN WITH OTHER WATER QUALITY PARAMETERS DURING HIGH TIDE IN A TROPICAL ESTUARY** R.P.P.K. Jayasinghe*, Mahendran Shitan, F.M. Yusoff, A. Arshad
1640 1645		**ACHIEVEMENTS AND LESSONS LEARNED IN RESTOCKING GIANT CLAMS** Edgardo D. Gomez*, Suzanne Mingoa-Licuanan		**LONG TERM CHANGES IN WATER QUALITY AND FISHERIES IN MUAR RIVER, MALAYSIA** N. Gopinath*, F.M. Yusoff
1700 1715		**THE CAUSES AND CONSEQUENCES OF ENHANCEMENT OUTCOMES: SOCIO-ECONOMIC LESSONS LEARNED FROM INLAND FISHERIES IN SOUTHEAST ASIA** Caroline Garaway		**TOXIC CYANOBACTERIAL BLOOM AND THE OCCURRENCE OF MICROCYSTIN FROM FRESHWATER EUTROPHIC PONDS IN BANGLADESH** Sagir M. Ahmed*, Jens Dahlmann, Bernd Luckas
1720				**FISH BLOOD AS POLLUTION INDICATOR IN AQUATIC ENVIRONMENT** Partha Bandyopadhyay, Biplab Sarkar, S. Adhikari, Bidhan C. Patra*
1740 1745				**MITIGATING ENVIRONMENTAL IMPACT OF CAGE CULTURE THROUGH INTEGRATED CAGE-CUM-COVE CULTURE SYSTEM IN TRI AN RESERVOIR OF VIETNAM** Le Thanh Hung*, Yang Yi, James S. Diana, C. Kwei Lin, Dinh The Nhan

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		Grand Ballroom 1 Advances in Shrimp Biotechnology 2 (Phylogeny & Epiderm, Bacteria in Shrimp Aquaculture)		Grand Ballroom 2 Understanding Aquatic Resources (Effects & Mitigation of Pollution, Critical Habitats, Invasive Species)		Grand Ballroom 3 Increasing Aquaculture Productivity (Breeding & Larviculture)
0830	KEYNOTE 4: PROF. HEW CHOY-LEONG					
0930	TEA BREAK					
1000	CHAIR : Peter Walker and Just Vlak	VARIATION IN INFECTIOUS HYPODERMAL AND HEMATOPOIETIC NECROSIS VIRUS (IHHNV) ISOLATES FROM DIFFERENT AREAS IN THAILAND Kanokporn Chayaburakul*, Siriporn Sriurairatana, Timothy W. Flegel, Kathy F.J. Tang, Bonnie T Poulos, Donald V. Lightner, Boonsirm Withyachumnarnkul	CHAIR : Law Ah Theem	ESTIMATED ECONOMIC VALUE OF HAIL HAOR AND ESTIMATION IN A WETLAND IN MALIJHEE FLOODPLAIN FOR BENEFIT OF RESOURCE MANAGERS AND COMMUNITY Munir Ahmed*, Md. Shahadat Ali, Md. Akhtaruzzaman, Sachin Halder, Bill Collis	CHAIR : Cheng-Sheng Lee and Mohd. Salleh Kamarudin	IMPROVED LOW COST INCUBATION SYSTEM TO INCREASE HATCHING AND SURVIVAL OF LARVAE FROM NATURALLY SPAWNED EGGS OF INDIAN MAJOR CARPS IN HALDA RIVER Mohammad Ali Azadi*, M. M. Kibria, M. Akhteruzzaman, Amrit N. Bart
1020		EPIDEMIOLOGIC ANALYSIS OF RISK FACTORS FOR WHITE SPOT DISEASE (WSD) IN BLACK TIGER SHRIMP *Penaeus monodon* CULTURE IN THAILAND Visanu Boonyawiwat*, Chalermpol Lekcharoensuk, Worawidh Wajjwalku, Jeffrey Davidson, Pornlerd Chanratchakool, T.W. Flegel		INTEGRATING FISH FARMING WITH MAKHANA *Eurale ferox* Janardan Jee*, Chandrawati Jee		NURSING OF HATCHERY PRODUCED *Penaeus monodon* POST-LARVAE (PL) IN FLOATING CAGES AS AN ALTERNATE LIVELIHOOD OPTION IN BANGLADESH H. Zamal
1040	CHAIR : Indrani Karunasagar and Claude Boyd	ENHANCEMENT OF WATER AND SEDIMENT QUALITY IN AQUACULTURE PONDS BY MICROORGANISMS Claude E. Boyd		INFLUENCE OF INDUSTRIAL POLLUTANTS ON THYROID AND INTER-RENAL FUNCTIONS IN THE FRESH WATER, AIR-BREATHING TELEOSTS *Channa punctatus* (BLOCH) Tapati Bhattacharya*, Kamal Ray		PROPAGATION OF FIRST GENERATION (F1) OF *Pangasianodon hypophthalmus* Ngan Heng*, Ouk Vibol, Ros Narin
1100				BIOCHEMICAL RESPONSE OF THE ORANGE-SPOTTED GROUPER *Epinephelus coioides* TO SUSPENDED SEDIMENT C.Y. Tse*, A.H. Pan, C.K. Wong, K.M. Chan		TILAPIA BREEDING IN TANK TO ENHANCE SEED PRODUCTION Suhairi Alimon
1120		PROBIOTICS AND IMMUNOSTIMULANTS IN SHRIMP CULTURE Sirirat Rengpipat		HISTOPATHOLOGICAL ALTERATIONS AS INDICATORS FOR EVALUATING THE SUBLETHAL EFFECTS OF SUSPENDED SEDIMENT ON THE ORANGE-SPOTTED GROUPER *Epinephelus coioides* A.P. Pak*, C.Y. Tse, O.N. Wong, K.M. Chan, C.K. Wong		PRELIMINARY RESULTS OF INDUCED SPAWNING AND NURSING OF *Cirrhinus microlepis* IN THE MEKONG DELTA, VIETNAM Trinh Quoc Trong*, Huynh Huu Ngai, Nguyen Minh Thanh, Thi Thanh Vinh, Dang Van Truong, Pham Dinh Khoi, Hoang Quang Bao, Nguyen Thi Hong Van
1140		EFFICACY OF PROBIOTICS AND IMMUNOSTIMULANTS IN DEVELOPING RESISTANCE AGAINST LUMINOUS VIBRIOSIS IN SHRIMP L. Jayasree*, P. Janakiram, R. Madhavi		STATUS OF MALAYSIAN CORAL REEF FISHERIES Annadel Salvio Cabanban*, Rooney Edward Biusing		CULTURE OF COPEPODS FOR MARINE FINFISH HATCHERIES Cheng-Sheng Lee*
1200	LUNCH and POSTER VIEWING (MATAHARI BALLROOM)					
1430	CHAIR : Indrani Karunasagar and Claude Boyd	BACTERIOPHAGES AND THEIR ROLE IN BIOCONTROL OF PATHOGENS IN AQUACULTURE Iddya Karunasagar, Indrani Karunasagar	CHAIR : K.K.U. Ahmed and Devin Bartley	MACROBENTHIC COMMUNITIES OF THE SITA – SWARNA ESTUARINE COMPLEX, WEST COAST OF INDIA H.R.V. Reddy*, R.S. Nagendra Babu, R.J. Katti	CHAIR : Anuar Hassan and Alex S.C. Chong	THE COMPARISON OF NATURAL AND ARTIFICIAL FROG *Rana rugulosa* BREEDING Somphanh Phanousith*, Bounsong Vongvichith
1450		EFFECTIVE CONTROL OF AMMONIA AND NITRITE IN COMMERCIAL SHRIMP PONDS USING A UNIQUE CONSORTIUM OF MICROBIAL NITRIFICATION STRAINS D. Drahos, P. Tacon*, T. Suyawanish, S. McHatton		BLOOMING OF PHYTOPLANKTON IN RELATION TO NUTRIENT FLUX IN HOOGHLY ESTUARY, NORTH EAST COAST OF BAY OF BENGAL T.K. De*, T.K. Jana		SOME ASPECTS OF REPRODUCTIVE BIOLOGY AND REARING OF YOUNG STAGES OF *Belontia signata* (GUNTHER) T.V. Sundarabarathy*, U. Edirisinghe, C.M.B. Dematawewa
1510		SCREENING OF PROBIOTIC BACTERIA EMPLOYING GFP-TAGGED Vibrio harveyi IN SHRIMP LARVAE Widanarni, A. Suwanto*, Sukenda, B. W. Lay		NUTRIENT CHANGES IN A SHALLOW TROPICAL RESERVOIR DURING WET AND DRY SEASONS Jamaludin Jafri*, Fatimah Md. Yusoff, Aziz Arshad, Perumal Kuppan		STUDIES ON SEED PRODUCTION OF GIANT FRESHWATER PRAWN *Macrobrachium rosenbergii* IN A BACKYARD HATCHERY S.T. Indulkar*, S. G. Belsare, P. C. Raje
1530		COPPER ADDITION TO CONTROL VIRULENCE OF PATHOGENIC VIBRIO AGAINST PENAID SHRIMP Tatsuya Nakayama*, Nakao Nomura, Masatoshi		PRELIMINARY STUDIES ON PRAWNSAT NAM OU RIVER, LUANG PRABANG PROVINCE, LAO PDR Latsamy Phounvisouk, Somboon		REMOVAL OF EGG STICKINESS IN AFRICAN GIANT CATFISH *Heterobranchus bidorsalis* O.T. Adebayo*, O.M. Batire
1550	TEA BREAK					
1620	CHAIR : Indrani Karunasagar and Claude Boyd	THE IMMUNE PARAMETERS OF WHITE SHRIMP *Litopenaeus vannamei* EXPOSED TO COPPER SULFATE Su-Tuen Yeh, Chun-Hung Liu, Jiann-Chu Chen*	CHAIR : K.K.U. Ahmed and Devin Bartley	STRUCTURE, COMPOSITION AND SEASONAL DYNAMICS OF THE POSTLARVAL AND JUVENILE SHELLFISHES IN THE SUNDARBANS MANGROVE WATERS, BANGLADESH M. Enamul Hoq*, M. Nazrul Islam, M. Abdul Wahab	CHAIR : Anuar Hassan and Alex S.C. Chong	WEANING PERIOD FOR *Heterobranchus bidorsalis* LARVAE O.T. Adebayo
1640		BACTERIOLOGICAL, LIGHT, AND SCANNING ELECTRON MICROSCOPE STUDIES ON VIBRIO SPECIES IN *Penaeus indicus* Salah H. Afifi		PATTERN OF ESTABLISHMENT OF TILAPIA IN RESERVOIRS IN MALAYSIA A.G. Ponniah*, Norainy Mohd Husin , Zulkafli Abdul Rashid		SUSTAINABLE CARP CULTURE THROUGH PARTICIPATORY AQUACULTURE TECHNOLOGY ASSESSMENT AND REFINEMENT BY WOMEN SELF HELP GROUPS B.B. Sahu*, H. K. De, M. K. Pati, N. Sarangi
1700		GROWTH PERFORMANCE OF *Penaeus monodon* GROWN UNDER ZERO WATER EXCHANGE AND ADJUSTED CARBON TO NITROGEN RATIO Pohan Panjaitan, Jim Luong-Van*		THE IMPACT OF INTRODUCED SPECIES ON THE GENETIC DIVERSITY OF NATIVE FRESHWATER FISHES IN MALAYSIA Yuzine b. Esa*, Khairul Adha A. Rahim		HATCHERY PRODUCTION AND GROW-OUT FARMING OF FRESHWATER PRAWN IN INDIA – RECENT DEVELOPMENT H. Shivanandha Murthy*, K. Thanuja
1720		SOURCE OF SALMONELLAE CONTAMINATION IN SHRIMP AQUACULTURE PRODUCTION IN WEST JAVA, INDONESIA Ratih Dewanti-Hariyadi*, Widya Rusanto, Harsi D. Kusumaningrum, Santoso		STUDY ON AN INTRODUCED FISH, *Helostoma temminckii* IN BAKONG RIVER, MIRI, SARAWAK: FACTORS AFFECTING ITS ESTABLISHMENT & SOCIO-ECONOMIC IMPACT Kelvin Pudun Dennis, Khairul Adha A. Rahim, Yuzine Esa		
1740				EXOTIC RED-BELLIED *Piaractus brachypomus* IN THE PHILIPPINES: POTENTIAL IMPACT TO RICE ECOSYSTEM Arsenia G. Cagauan*, Ravindra C. Joshi		

3 DECEMBER 2004

		Serindit Enhancing the Ornamental Fish Industry, Improve Resource Use Efficiency in Asian Integrated Pond-dike Systems		**Tekukur** Promoting Environment-Friendly Management (Reducing Risks of Diseases)		**Bayan** Advances in Seaweed Cultivation and Utilization in Asia
0830	**KEYNOTE 4: PROF. HEW CHOY-LEONG** (GRAND BALLROOM)					
0930	**TEA BREAK** (GRAND BALLROOM FOYER)					
1000	CHAIR : Ismail Awang Kechik	**EVALUATION OF POLYMERASE CHAIN REACTION (PCR) FOR DETECTION OF KOI HERPES VIRUS (KHV) FROM COMMON CARP AND KOI IN INDONESIA** Yul kurniatun, A.Sony Adi Susanto, Antonius Suwanto*	CHAIR : Tokhmafshan Mohammed	**INCREASE IN DENSITY WITH TIME OF TWO PARASITES *Trichodina* sp. AND *Cichlidogyrus* sp. INFECTING *Oreochromis niloticus* FINGERLINGS IN PACKING BAGS FOR TRANSPORT** Apolinario V. Yambot*, Jesusa S. Quimson	CHAIR : Alan Critchley	**CROP IMPROVEMENT IN SEAWEED CULTIVATION** Phang Siew Moi, Gan Sook Yee, Qin Song
1020		**FRESH WATER ORNAMENTAL FISHES OF KERALA, INDIA, THEIR POTENTIAL AND CAPTIVE SURVIVAL IN AQUARIA** A. Ramachandran *, N. Mini Sekharan, P.K. Pramod		**EPIZOOTIOLOGICAL STUDY ON MASS MORTALITIES OF THE CULTURED SCALLOPS *Chlamys farreri* AND *Argopecten irradians*** Weizhu Zhang, Xinzhong Wu*, Jingfeng Sun, Dengfeng Li, Yang Zhang, Xia Yang		
1030						**MOLECULAR TAXONOMY OF SEAWEEDS WITH EMPHASIS ON RHODOPHYTA AND PHAEOPHYTA** Lim Phaik-Eem, Wong Ching-Lee, Phang Siew-Moi
1040		**BLACK DISEASE IN LARVAL AND ADULT *Artemia urmiana* IN IRAN** Maria Betty B. Ras*, Ali Asghar Tehrani, Rahim Hobbenaghi, Naser Agh, Gilda Lio-Po		**IDENTIFICATION OF WHITE SPOT SYNDROME VIRUS (WSSV) IN *Penaeus indicus* BY POLYMERASE CHAIN REACTION (PCR) IN IRAN** Tokhmafshan, Mohammad*, Laloei, Framarz, Rezvani, Sorab		
1100		**RECENT ADVANCES IN THE DEVELOPMENT OF CAPTIVE BREEDING TECHNOLOGY FOR THE INDIGENIOUS ORNAMENTAL FISHES OF THE WESTERN GHATS OF INDIA** T.V. Anna Mercy*, Eapen Jacob		**INVESTIGATION OF THE INNATE RESPONSES OF THE PRE-BROODS OF *Oncorhynchus mykiss* TO STRESS REPEATABILITY** Akbari, S. Ameri, A., Y. Mehrabi	CHAIR : Ang Put Jr.	**FUNCTIONAL GENOMIC RESEARCH OF *Gracilaria changii* A TROPICAL SEAWEED** Chai-Ling Ho*, Swee-Sen Teo, Seddon Teoh, Jin-Ming Tee, Siew-Moi Phang
1120		**EFFECT OF DIFFERENT PROTEIN AND LIPID LEVELS IN BROODSTOCK DIET ON THE GROWTH AND REPRODUCTIVE PERFORMANCE OF FEMALE *Xiphophorus helleri* (POECILIIDAE)** Shirley Ling*, Roshada Hashim, Sagiv Kolkovski, Alexander Chong				
1130						**QUALITY CONTROL OF ECONOMIC SEAWEEDS (WITH PARTICULAR REFERENCE TO CARRAGEENOPHYTES)** A.T. Critchley*, G. Bleicher Lhonneur, J.P. Lhonneur, A. Trespoey
1140		**ORIENTATION OF PIGMENT MOLECULES IN ORNAMENTAL FISHES OF FRESHWATER AQUATIC SYSTEM AND THEIR ASSOCIATED HEALTH PROBLEMS AND IDENTIFICATION OF SOME FEED ADDITIVE IN RESTORATION** Umesh C. Goswami				
1200		**ORNAMENTAL FISHERIES PROSPECT AND SCOPE: A CASE STUDY FROM ARUNACHAL PRADESH** P. Nath*, D.N. Das				
1220	**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)					
1430	CHAIR : Roel Bosma	**SEDIMENT ACCUMULATION IN FISH PONDS: ITS QUANTITY AND QUALITY AS A CROP FERTILIZER** P.N. Muendo*, J.J. Stoorvogel, G. El Naggar, A. Milstein, A.A. Van Dam, M.C.J. Verdegem			CHAIR : Ang Put Jr.	**CARRAGEENAN PRODUCTION BY TACARA SDN. BHD. IN TAWAU, SABAH, MALAYSIA** David Young Chung-Wai
1450		**POND-DIKE SYSTEMS AND LIVELIHOOD IN RURAL AND PERI-URBAN AREAS OF MYMENSINGH DISTRICT OF BANGLADESH - A REVIEW THROUGH PCA (PARTICIPATORY COMMUNITY APPRAISAL) METHOD** Manjurul Karim *, David C. Little, Md. Shamsul Kabir, Md. Abdul Wahab, Marc Verdegem				
1500						**PRODUCTION OF QUALITY DRIED SEAWEED: CHALLENGES AND STRATEGIES** Charles Santhanaraju Vairappan
1510		**COMPARISON BETWEEN LOW INPUT AND HIGH INPUT INTEGRATED POND-DYKE AQUACULTURE SYSTEMS IN SOME VILLAGES OF MUKTAGACHA, BANGLADESH** Md. Shamsul Kabir*, Md. Abdul Wahab, Manjurul Karim, Marc Verdegem, David Little				
1530		**SEDIMENTATION AND NUTRIENTS BUILD UP IN TILAPIA PONDS UNDER DIFFERENT INPUT SYSTEMS** Md. Mizanur Rahman, Amararatne Yakupitiyage				
1550	**TEA BREAK**					
1620	CHAIR : Roel Bosma	**THE NUTRITIVE VALUE OF TILAPIA POND WATER AND SLUDGE FOR CHILLI CULTIVATION** Amararatne Yakupitiyage, S.L. Ranamukhaarachchi, Md. Mizanur Rahman			CHAIR : Junaidi Che Ayub	**DISCUSSION**
1640		**FOOD PREFERENCE OF COMMON CARP Cyprinus carpio AND ROHU Labeo rohita IN MONOCULTURE AND POLYCULTURE: SHIFTS IN GRAZING ON PLANKTON UNDER FED AND UNFED CONDITIONS** M. Mustafizur Rahman*, M.C.J. Verdegem, M.A. Wahab				

3 DECEMBER 2004

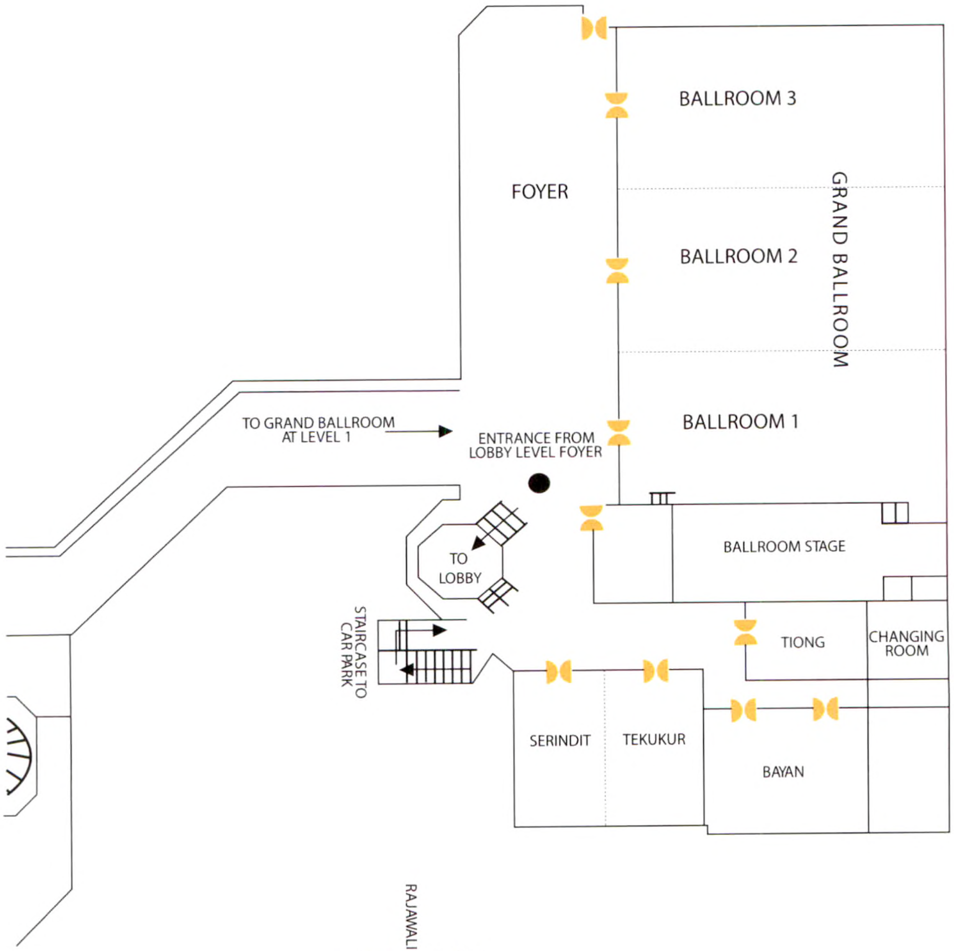
		Pekaka Restoring & Sustaining Capture Fisheries (Habitat Restoration, Resource Enhancement, Reducing By-Catch)		**Murai 1** Restocking & Stock Enhancement of Coastal Fisheries		**Murai 2** Managing Fishing Impacts on Sharks & Rays (Biology & Fisheries, Management & Conservation)
0830		**KEYNOTE 4: PROF. HEW CHOY-LEONG** (GRAND BALLROOM)				
0930		**TEA BEAK** (GRAND BALLROOM FOYER)				
1000	**CHAIR** : Madhusoodana Kurup and Eric Baran	**BRUSH AND VEGETATION PARK FISHERY IN THE FLOODPLAIN RIVER TITAS, BRAHMANBARIA, BANGLADESH** Md Sagir Ahmed	**CHAIR** : Shuichi Kitada	**RECREATIONAL ANGLERS' WILLINGNESS TO PAY FOR INCREASED CATCH RATES OF PACIFIC THREADFIN *Polydactylus sexfilis* IN HAWAII** Robert N. Cantrell, Marissa C. Garcia*, PingSun Leung, David Ziemann	**CHAIR** : Ilona Stobutzki and Steve Blaber	**THE CHALLENGES FACING MANAGEMENT AND CONSERVATION OF CHONDRICTHYANS IN ASIA** Ilona Stobutzki*, Stephen Blaber
1020		**PARTNERSHIPS, COLLABORATION AND COOPERATION FOR EFFECTIVE MARINE RESOURCES MANAGEMENT: THE FIJI LOCALLY MANAGED MARINE AREAS (FLMMA) NETWORK** Joeli Veitayaki*, Sakiusa Fong, Isoa Korovulavula, Semisi Meo				**THE RECORDS OF ELASMOBRANCH SPECIES FROM MALAYSIA** Ahmad bin Ali*, Yano, Kazunari, Albert, Chuan Gambang, Sollahuddin, A. Razak, Aznan Zainal
1030				**STOCK ENHANCEMENT IN TAIWAN** I Chiu Liao, Eduardo M. Leaño*		
1040		**PRAWN LANDINGS AND THEIR RELATIONSHIP WITH THE EXTENT OF MANGROVES AND SHALLOW WATERS IN WESTERN PENINSULAR MALAYSIA** N.R. Loneragan*, N. Ahmad Adnan, R.M. Connolly, F.J. Manson				**A PROGRESS REPORT ON COLLABORATIVE RESEARCH INTO THE SUSTAINABILITY OF AUSTRALIA'S NORTHERN SHARKS AND RAYS** John Salini*, Richard Pillans
1100		**SIDE SCAN SONAR IMAGES OF ARTIFICIAL REEFS** Dae Choul Kim, Gwang H. Lee, Young Kyo Seo		**STOCK *ENHANCEMENT PROGRAMS OF KURUMA PRAWN* *Marsupenaeus japonicus* IN JAPAN: STOCKING EFFECTIVENESS AND RELEASE STRATEGY** Katsuyuki Hamasaki		**STUDIES ON THE DOGFISH SHARK FISHERY IN THE NORTHWESTERN COASTAL REGION OF SRI LANKA** D.C.T. Dissanayake*, R.A.M. Jayathilaka, C. Amarasiri
1120		**IMMEDIATE IMPACT OF BOTTOM TRAWLING ON MACROBENTHOS WITH SPECIAL REFERENCE TO POLYCHAETES IN THE INSHORE WATERS OF SOUTHWEST COAST OF INDIA** Joice V.Thomas, B. Madhusoodhana Kurup*		**STOCK ENHANCEMENT AND TRANSPLANTATION OF MARINE SHRIMP *Fenneropenaeus chinensis* IN CHINA** Wang Qing-Yin*, Zhuang Zhi-Meng, Deng Jing-Yao		SOME ASPECTS OF SHARK AND RAY ARTISANAL FISHERIES IN SOUTH OF INDONESIA Dharmadi*, Fahmi, W.T. White, J. Widodo
1130						
1140						**SIZE COMPOSITION AND FISHERY STATUS OF SOME COMMON SHARKS IN INDONESIAN WATERS** Fahmi*, Kurnaen Sumadhiharga
1150						
1200		**LUNCH and POSTER VIEWING** (MATAHARI BALLROOM)				
1430	**CHAIR** : Chee Paik Ean and M.R. Hasan	**IMPACT OF STOCKING ON YIELD AND BIODIVERSITY OF NON-STOCKED INDIGENOUS FISH SPECIES IN OXBOW LAKES WITH SPECIAL REFERENCE TO ENVIRONMENT AND LIVELIHOOD** M.R. Hasan*, M.M.R. Talukder	**CHAIR** : Shuichi Kitada	**NEW DIRECTIONS FOR RESEARCH IN PRAWN (=SHRIMP) ENHANCEMENT: EXPERIENCE FROM EXMOUTH GULF, AUSTRALIA** Neil R Loneragan*, Yimin Ye, Rob A. Kenyon, Mick D. E. Haywood	**CHAIR** : Ilona Stobutzki and Steve Blaber	**ELASMOBRANCH RESOURCES OF SABAH, MALAYSIA** B. Mabel Manjaji*, Rooney Biusing, Annadel Cabanban
1450		**SEASONAL ABUNDANCE OF BENTHIC COMMUNITIES IN CORAL AREAS OF PULAU KARAH, TERENGGANU, MALAYSIA** Wan Mohd Rauhan Wan Hussin*, Sakri Ibrahim, Zaleha Kassim, Sukree Hajisamae				**ARTISANAL ELASMOBRANCH FISHERIES IN SOUTH-EASTERN INDONESIA: THE TARGET LONGLINE FISHERY FOR SHARKS IN LOMBOK** William T. White*, Dharmadi, Fahmi
1500				**POTENTIAL FOR ENHANCING SPINY LOBSTER PRODUCTION IN AUSTRALIA THROUGH THE CAPTURE OF PUERULUS LARVAE FOR ONGROWING AND RELEASE** Caleb Gardner*, Stewart Frusher, David Mills, Megan Oliver		
1510		**UNDERSTANDING FISH FIGHTS OVER FISH RIGHTS: CONFLICTS AND OVERCAPACITY IN FISHERIES IN SOUTHEAST ASIA** Kuperan Viswanathan, Len Garces*, Nerissa Salayo, Mohammed Rab				**SOCIO-ECONOMIC ASPECTS OF SHARK AND RAY FISHING IN INDONESIA** Malcolm Tull, Simon Vieira
1530		**EFFECT OF FISH STOCKING SIZE, DENSITY AND FERTILIZER ON WATER QUALITY IN RICE FIELDS FOR PRODUCTIVITY ENHANCEMENT IN INTEGRATED RICE-FISH FARMING IN HILLS OF NEPAL** Suresh Kumar Wagle, Tek Bahadur Gurung, Jay Dev Bista		**CONTRIBUTION OF STOCKED MUD CRAB *Scylla paramamosain* TO COMMERCIAL CATCH ESTIMATED BY GENETIC STOCK IDENTIFICATION** Yasuhiro Obata		**TOWARD A REGIONAL POLICY FOR THE MANAGEMENT OF SHARK FISHERIES IN SOUTHEAST ASIA** Olivier Delahaye Gamucci*, Trian Yunanda
1550		**TEA BREAK**				**TEA BREAK**
1600				**TEA BREAK**		
1620	**CHAIR** : Chee Paik Ean and M.R. Hasan	**THE ANGELWINGS (FAMILY PHOLADIDAE) OF THE PHILIPPINES: STATUS AND PROSPECTS FOR DEVELOPMENT** Liberato V. Laureta			**CHAIR** : Ilona Stobutzki and Steve Blaber	**NATIONAL PLAN OF ACTION FOR SHARKS IN INDONESIA** Johannes Widodo, Rachel D. Cavanagh*
1630			**CHAIR** : Shuichi Kitada	**STOCK ENHANCEMENT AND AQUACULTURE OF ANADARA GRANOSA (BLOOD COCKLES) IN RELATION TO OTHER COASTAL ACTIVITIES IN PENANG, MALAYSIA** Ian Bryceson*, Mohd Zambri Mohd Akhir, Mohd Noor bin Noordin		
1640		**IMPROVEMENT OF FISHERY RESOURCES IN CHILIKA LAGOON AFTER OPENING OF THE NEW MOUTH** K.S. Bhatta*, A.K. Pattnaik, S. Mishra				**SHARK CATCHES IN MALAYSIA** Abd.Haris Hilmi Ahmad Arshad*, Ahmad Ali, Albert Chuan Gambang, Ahemad Sade, Lim Chai Fong
1700		**SOME CONSIDERATIONS ON THE POPULATION DYNAMICS OF *Thunnus albacares* IN THE OMAN SEA** Farhad Kaymaram*, Bahram Kiabi	**CHAIR** : Johann Bell	**DISCUSSION**		**ASSESSING THE SUSTAINABILITY OF ELASMOBRANCHS IN INDONESIAN ARTISANAL FISHERIES USING RISK ASSESSMENT TECHNIQUES** Richard Pillans*, Margaret Miller
1720		**COMPUTERIZED FISHING GEAR DESIGN AND SIMULATION TOOL** Chun-Woo Lee*, Ju-Hee Lee, Byeong-Guk Guk, Hyeong-Seok Kim, Gun-Ho Lee, Kwi-Yeon Koo				**RECENT RECORDS OF Glyphis AND Lamiopsis FROM NORTHERN AUSTRALIA AND SOUTH-EAST ASIA** H.K. Larson, P.R. Last, R.D. Pilllans, J.D. Stevens*, D.C. Thorburn
1740						**SAWFISH (PRISTIDAE) CATCH DATA IN NORTHERN AUSTRALIAN WATERS; A DESKTOP STUDY** Jenny Giles

Floor Plan

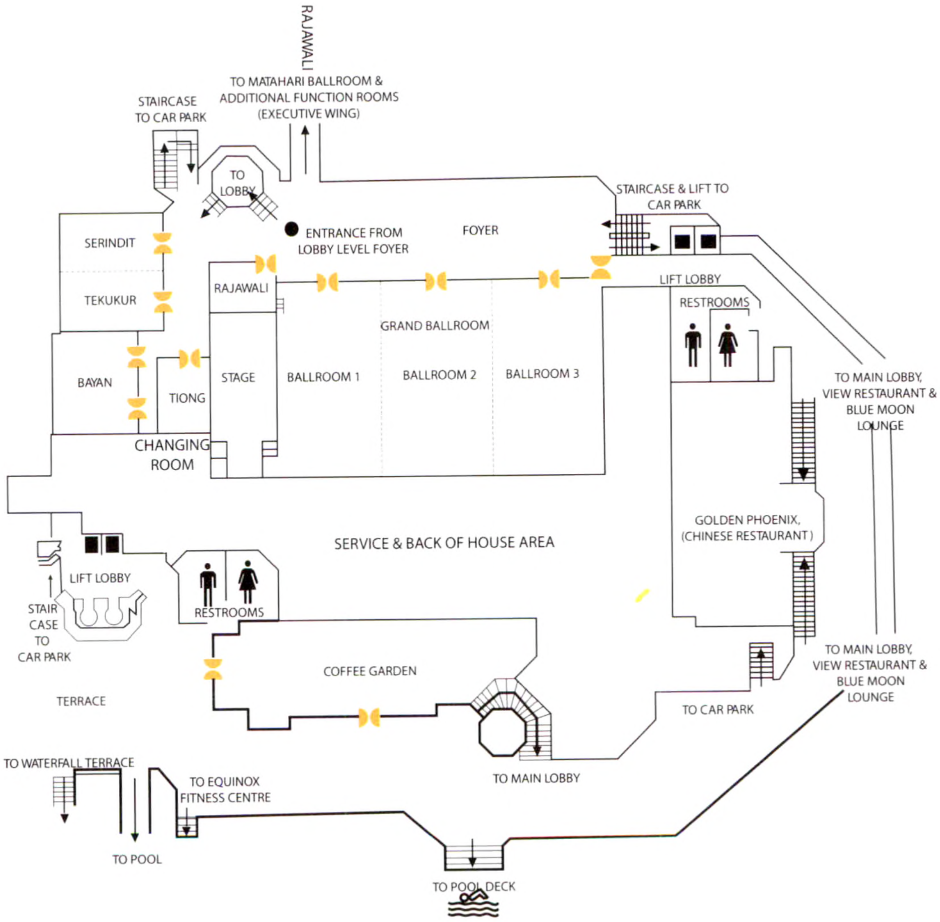
Scientific Programme

Exhibition and Meals Venue

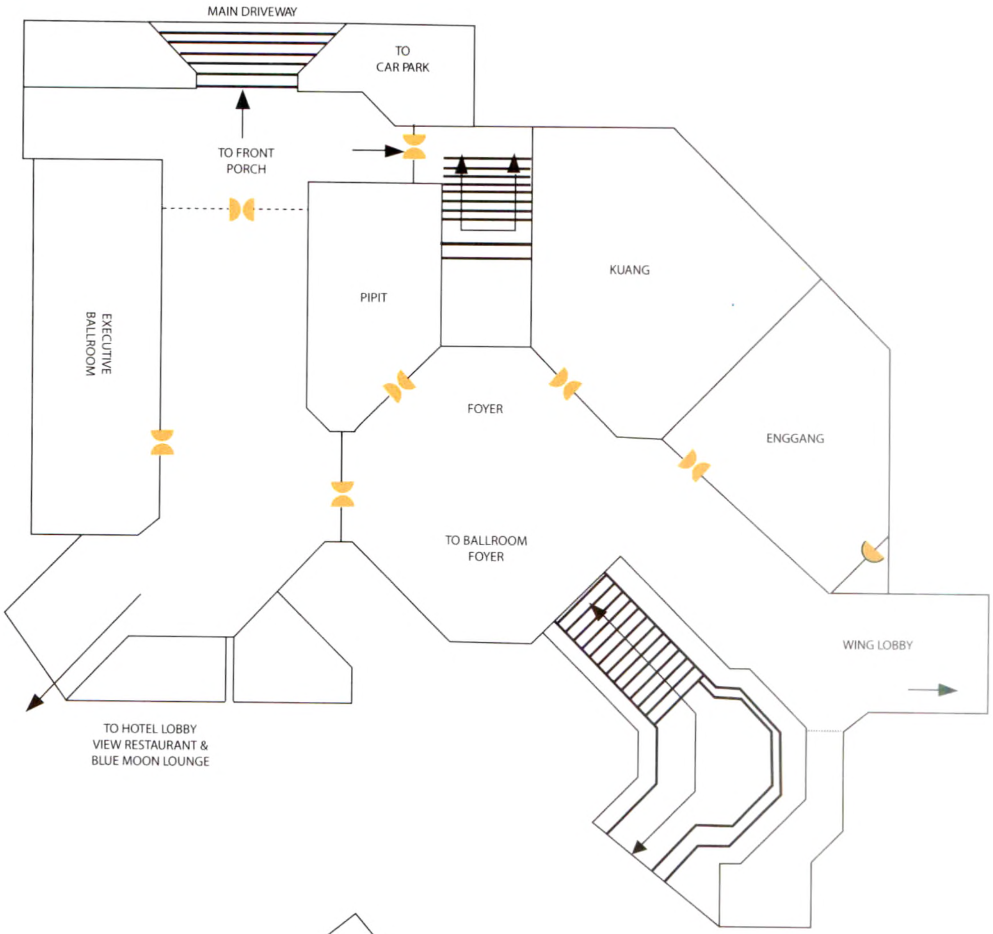
Scientific



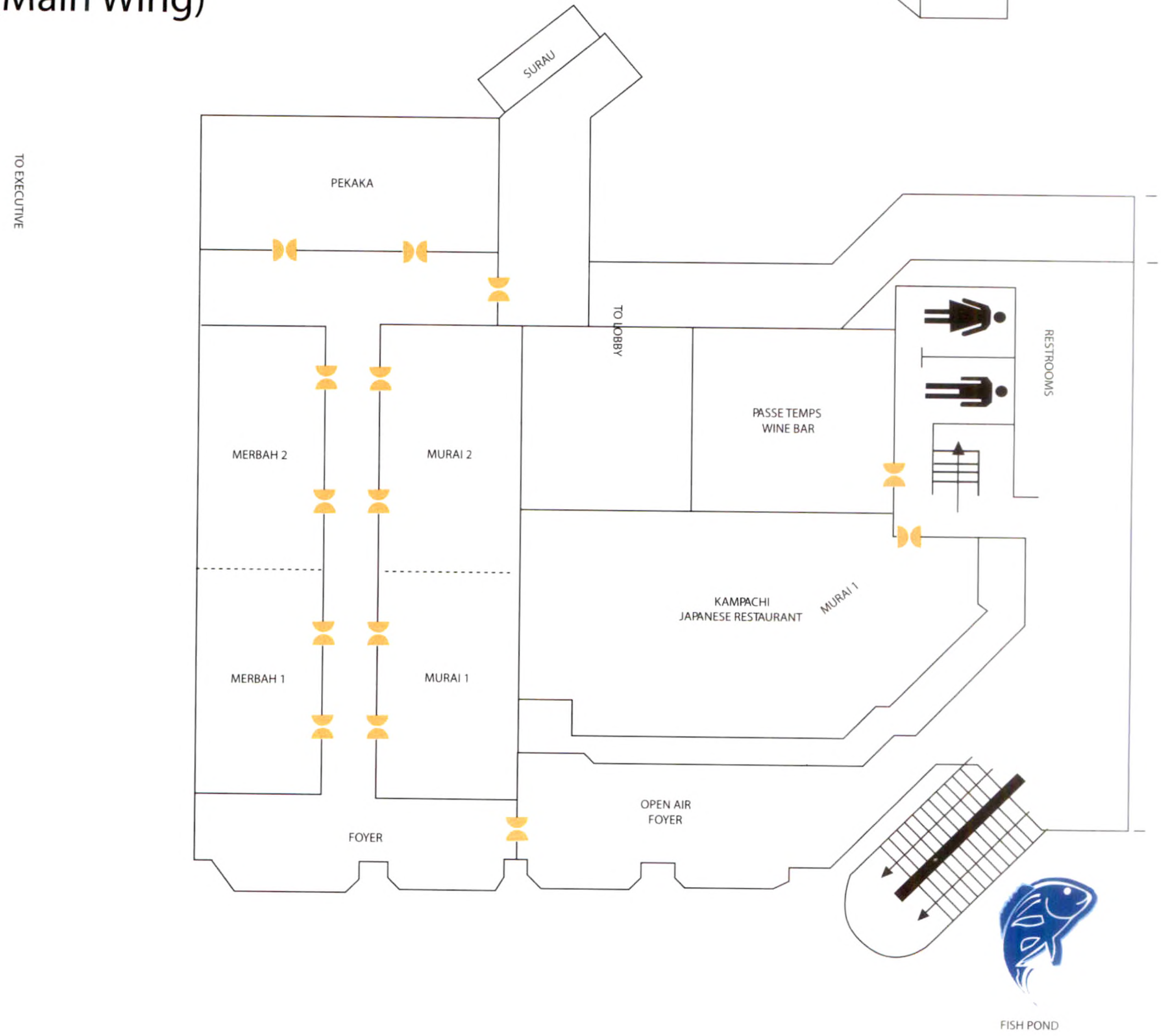
Lower Level 1


RAJAWALI
TO MATAHARI BALLROOM & ADDITIONAL FUNCTION ROOMS (EXECUTIVE WING)
STAIRCASE TO CAR PARK
TO LOBBY
ENTRANCE FROM LOBBY LEVEL FOYER
FOYER
STAIRCASE & LIFT TO CAR PARK
SERINDIT
TEKUKUR
RAJAWALI
LIFT LOBBY
RESTROOMS
GRAND BALLROOM
BAYAN
STAGE
TIONG
BALLROOM 1
BALLROOM 2
BALLROOM 3
TO MAIN LOBBY, VIEW RESTAURANT & BLUE MOON LOUNGE
CHANGING ROOM
GOLDEN PHOENIX, (CHINESE RESTAURANT)
SERVICE & BACK OF HOUSE AREA
LIFT LOBBY
STAIR CASE TO CAR PARK
RESTROOMS
COFFEE GARDEN
TO MAIN LOBBY, VIEW RESTAURANT & BLUE MOON LOUNGE
TERRACE
TO CAR PARK
TO WATERFALL TERRACE
TO EQUINOX FITNESS CENTRE
TO MAIN LOBBY
TO POOL
TO POOL DECK

Programme

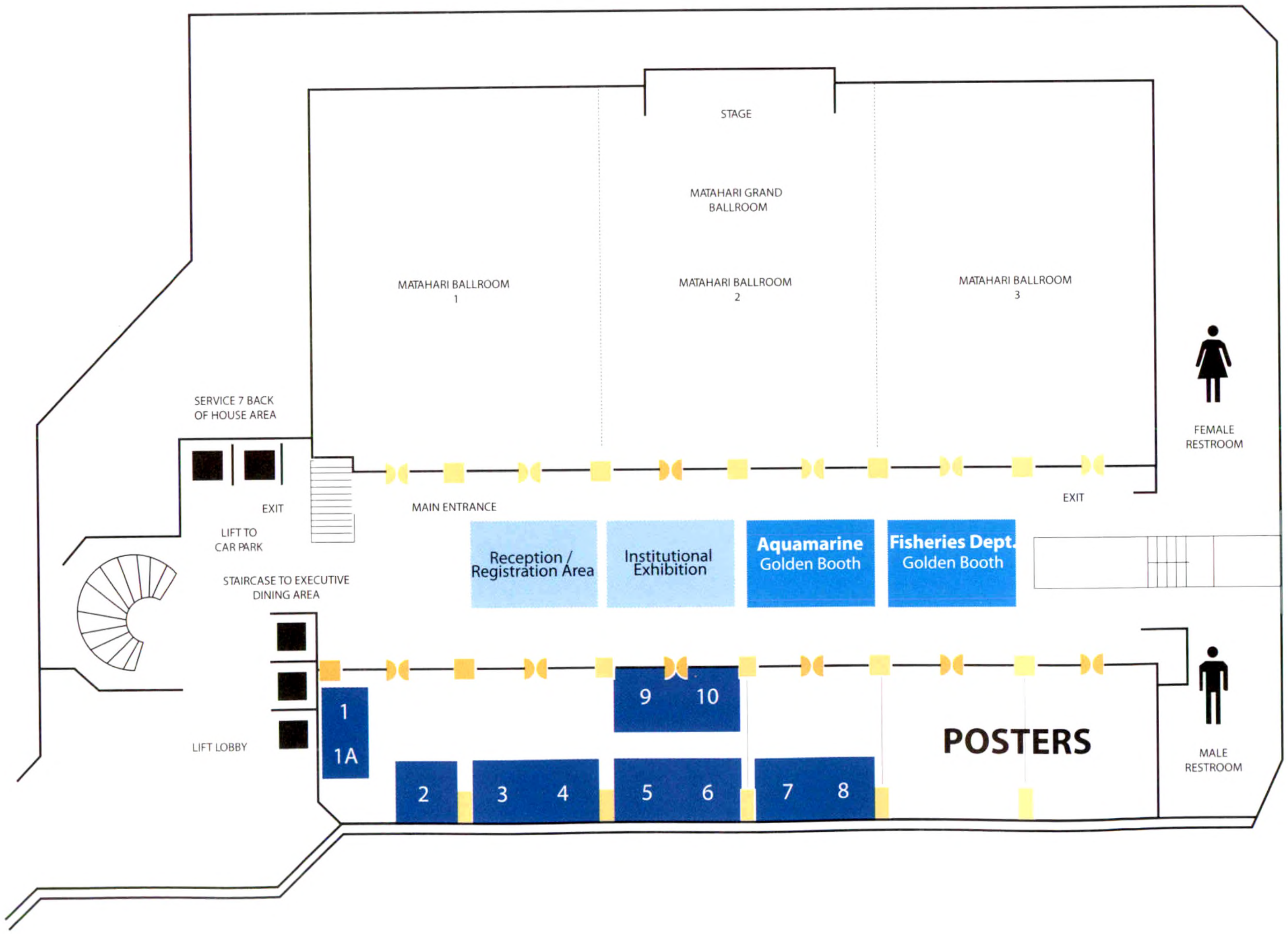


(Main Wing)



Exhibition and Meals Venue

Lower Level 1 (Executive Wing)

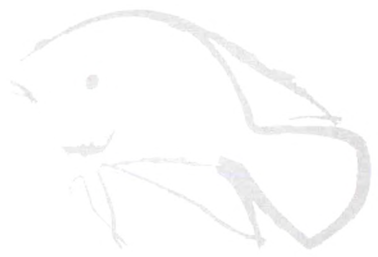


Golden Booth

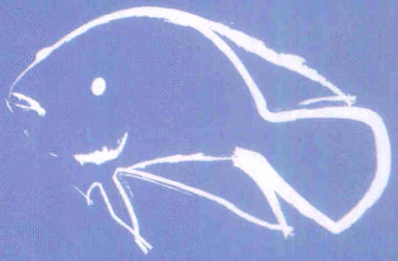
1	Aquamarine Ind. Sdn. Bhd.
2	Fisheries Department

Standard Booth

1	Fisheries Development Authority of Malaysia
1A	Asia Star Lab Co. Ltd
2	Rotomas Technology (M) Sdn. Bhd.
3	Qgene Biotechnology Inc. (Taiwan)
4	Shrimp Biotechnology Business Unit
5	DFID Aquaculture and Fish Genetics Research
6	LBSB Bio Reco Sdn. Bhd.
7	Bio-Rad Laboratories(s) Pte. Ltd.
8	Arachem (M) Sdn. Bhd.
9	AWT Fusion Marine Sdn. Bhd.
10	Hunza Consolidation Berhad



Exhibitors



Aqua Marine

Aquamarine Industries Sdn Bhd.

is a member of the Association of Rotational Moulders. Mr. Bluey Chew, our Executive Director, has been elected by its member to be the president of the board committee members steering the expansion and growth of the Rotational Moulding Industries as a whole for the benefits of all its members.

The Association of Rotational Moulders (ARM) is an international trade association currently representing member companies in 57 countries. Member include manufacturers of rotationally molded plastic products, suppliers to the industry, designers, and professionals. ARM is the primary voice of the industry and the source for information on rotational moulding. The Association serve its members by focusing on the needs of designers, customers, educators, suppliers, member company employees, and regulator.

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D/L: 605 7166039
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Jabatan Perikanan
Malaysia

Department of Fisheries

MISSION:

To develop and manage the country's fisheries sector in a dynamic, competitive and sustainable manner based on scientific research and quality services.

VISION:

To increase the national fish production and balance of trade as well as establish a successful target group by the year 2010.

OBJECTIVES:

- To realize a national fish production target of two (2) million tonnes per year through the increment in deep-sea fisheries to 500,000 tonnes, aquaculture 600,000 tonnes and maintaining coastal fisheries production at 900,000 tonnes.
- To achieve a balance of trade of RM 4 billion per year through the contribution of the 10 established major products.
- To guarantee a minimum nett income of RM 3,000 per month for fisheries entrepreneurs.
- To ensure the income of fishermen exceed the poverty level.

FUNCTIONS

- Formulation and implementation of policies and strategies for the overall development and management of the fisheries sector.
- Implementation of the Fisheries Act 1985.
- Conservation of fisheries resources for sustainable development.
- Research, development and training for the promotion of new technology consistent with sustainable marine fisheries and environment friendly aquaculture.
- Extension services for marine fisheries and aquaculture.

General Information

In line with the objectives of the Department of Fisheries Malaysia, there are tremendous potentials for investment opportunities especially in commercial scale aquaculture, tuna fishing in the Indian Ocean and downstream processing of fish and fish products. Foreign investments and joint ventures with local entrepreneurs are welcome to help accelerate the development of the industry.

Malaysia is also a leading producer of ornamental fish for the world market. The quality of the Asian Arowana and Discus fish exported from Malaysia are second to none. Penang Discus fish are renowned worldwide for their quality and variety and have won many top prizes at prestigious shows in Germany and AQUARAMA shows.

Department of Fisheries
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Jalan Sultan Salahuddin
50628 Kuala Lumpur. Malaysia
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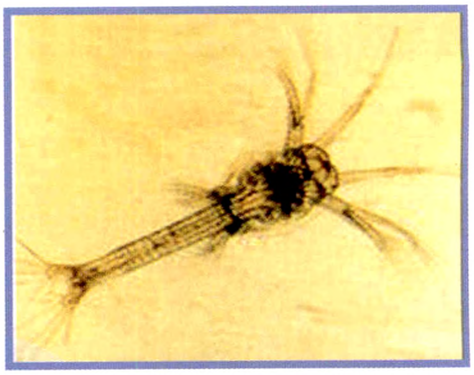
Fisheries Development Authority of Malaysia

The Fisheries Development Authority of Malaysia (FDAM) or Lembaga Kemajuan Ikan Malaysia (LKIM) is a statutory body, under the Ministry of Agriculture established through the Fisheries Development Authority of Malaysia Act 1971. The Act was enforced on 1st November 1971 in Peninsular Malaysia on 1st July 1973 in Sarawak, and 0n 1st August 1995 in Sabah.



The main objectives of LKIM are:-

To improve the socioeconomic status of fishermen with emphasis on increasing their income, and

To expand and develop the nation's fisheries industry.

To form and create a self reliant, dedicated and progressive fishermen community which is able to move in line with the nation's development and etablish a modern fisheries industry.

FISHERIES DEVELOPMENT AUTHORITY OF MALAYSIA
(LKIM)
7,8,9,10 & 11 Floor, Wisma PKNS,
Jalan Raja Laut, 50784
Kuala Lumpur.
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FAX: 03-2691 1931
Teleks: IKAN MA 30054
agrolink.moa.my/lkim/

Asia Star Lab Co. Ltd

was founded in January 1999 team developers of aquacultural specialists, chemists, And pharmacists with long experience and clear understanding in aquaculture in Thailand. With the support of our parent company " Phisit Group of companies ", the chemical companies with over 27 years of history, who were expert in textile & leather dyestuffs and biological chemical for environment

As well as the technological support from R.X. Co., Ltd., pharmaceutical company, which active in generic, branded and innovative medicines, active Pharmaceutical ingredients, hospital supplies, and excimer laser. The two companies are combined, to further develop chemical and pharmaceutical technology disciplines and also develop aquaculture solutions as a global entity.

Asia Star Lab Co., Ltd. specializes in aquatic farming technology and machinery. We are not only the importer but also manufacturer and exporter in the field of aquaculture with the aim to provide alternative aquaculture technology solutions. Our products are currently divided into five categories under the brand ASIA STAR LAB ;

Vitamin & Feed additives, Microorganisms and Water Conditioner Antibiotic Medicines, Disinfectant, Chemicals

With our high and innovative technology of aquaculture products of international quality, day to day increase its productions technology, to satisfy the demands of our local market as well as international market. We have exported our qualified products worldwide.

Our lines of products are used and accepted widely by many farmers. We have provided highly effective environmentally friendly alternatives to hazardous and outdated chemicals in these establishments. In response to rapidly growing demands for environmentally benign yet effective alternatives to current products used in the shrimp farming in many countries and definitely in Thailand, the world's largest producer of shrimp remarkably BlackTiger Prawns . Asia Star Lab Co., Ltd. has invested heavily in research and development to find better solutions for these problems. The effort resulted in the formulation is one of the most innovative products for the aquaculture to date.

Under the promise that the new millennium is the age of biotechnology, Asia Star Lab Co., Ltd. endeavors to provide aquaculture technology and natural solutions for environmental and health problems in order to upgrade the quality of life .

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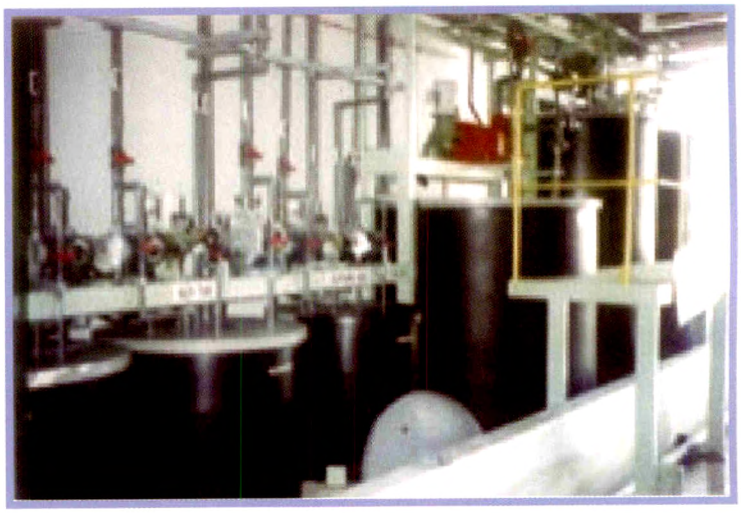
www.asiastarlab.com

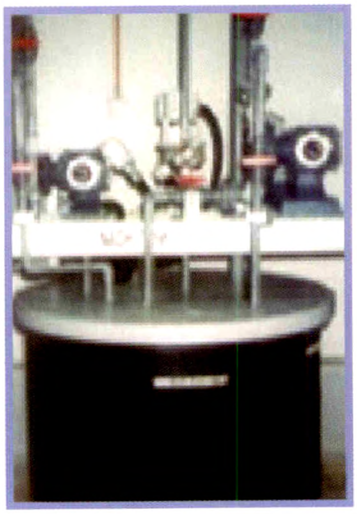
ROTOMAS

Rotomas Technology (M) Sdn. Bhd.

is a member of the Association of Rotational Moulders. Mr. Bluey Chew, our Executive Director, has been elected by its member to be the president of the board committee members steering the expansion and growth of the Rotational Moulding Industries as a whole for the benefits of all its members.

The Association of Rotational Moulders (ARM) is an international trade association currently representing member companies in 57 countries. Member include manufacturers of rotationally molded plastic products, suppliers to the industry, designers, and professionals. ARM is the primary voice of the industry and the source for information on rotational moulding. The Association serve its members by focusing on the needs of designers, customers, educators, suppliers, member company employees, and regulator.





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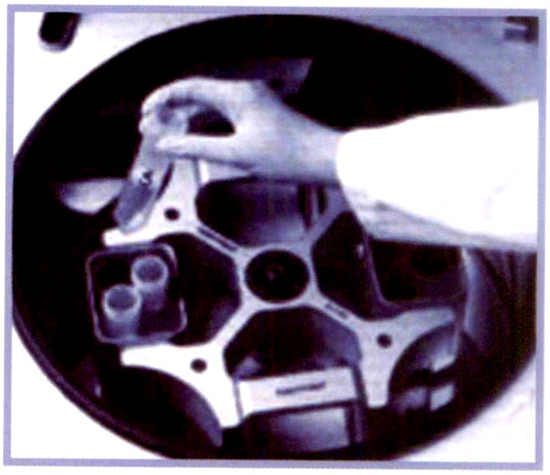
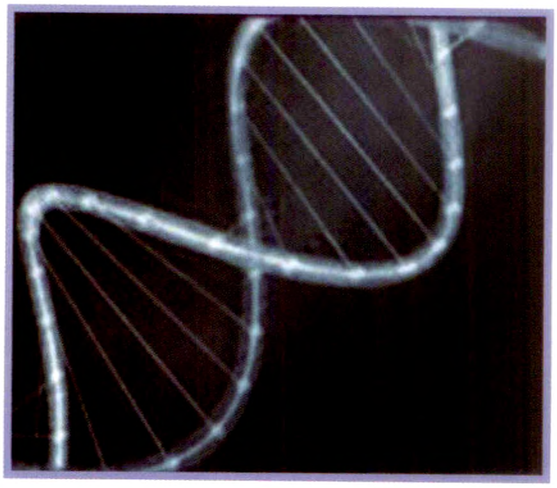
Fax: 603 - 87233733
www.rotomas.com

QGENE Biotechnology Inc.
Taiwan

specialized in viral genetics had developed a fast, sensitive and reliable total solution diagnostic system using the latest technology – real time quantitative PCR for accurate, precise detection and control of WSSV. Shrimp white spot syndrome virus (WSSV) continues to cause serious economical losses in shrimp industries world wide. Using certified SPF or virus free broodstock and seedstock increase the rate of successful harvest greatly. Also, regular monitoring of viral load changes during cultivation enables an early detection of disease outbreak. From laboratory design, diagnostic testing to technical support we provide a total solution service.





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Kaohsiung,
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www.qgene.com.tw

หน่วยธุรกิจโครงการเทคโนโลยีชีวภาพกุ้ง

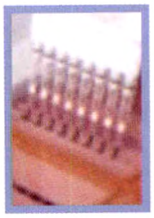
SBBU

SHRIMP BIOTECHNOLOGY BUSINESS UNIT

SBBU Shrimp Biotechnology Business Unit

The Shrimp Biotechnology Business Unit (SBBU) was established by the Thailand National Center for Genetic Engineering and Biotechnology (BIOTEC) in Bangkok, Thailand. SSBU has been working since 1999 to commercialize solutions developed by the Thai research to help the shrimp industry.

We invite you to come and discover our diagnostic kits (PCR kits and test strips) as well as SBBU expertise in shrimp health management, which ranges from diagnostic analysis, to contract research for the shrimp industry, training and consulting.



SBBU Shrimp Biotechnology Business Unit
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Fax: +66 2 247-7051
www.shrimpbiotec.com

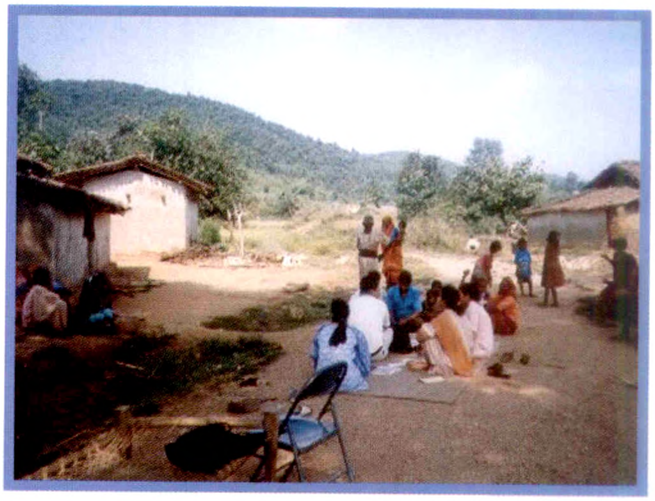
DFID Department for International Development

AFGRP aquaculture and fish genetics research programme

UNIVERSITY OF STIRLING

Department for International Development

AFGRP funds projects around the world, although mostly in Asia where aquaculture is of most importance, looking at aspects of fish health, genetics, nutrition, environment and interaction with other sectors, like agriculture, and social implications of aquaculture. By improving knowledge of the importance of aquatic systems in the wider environmental and social context, AFGRP aims to improve the productive benefits specifically for poor people and ensure sustainable use of natural resources. At AFF we aim to provide organisations with packages of appropriate information that can be used for aquaculture development at the national level.

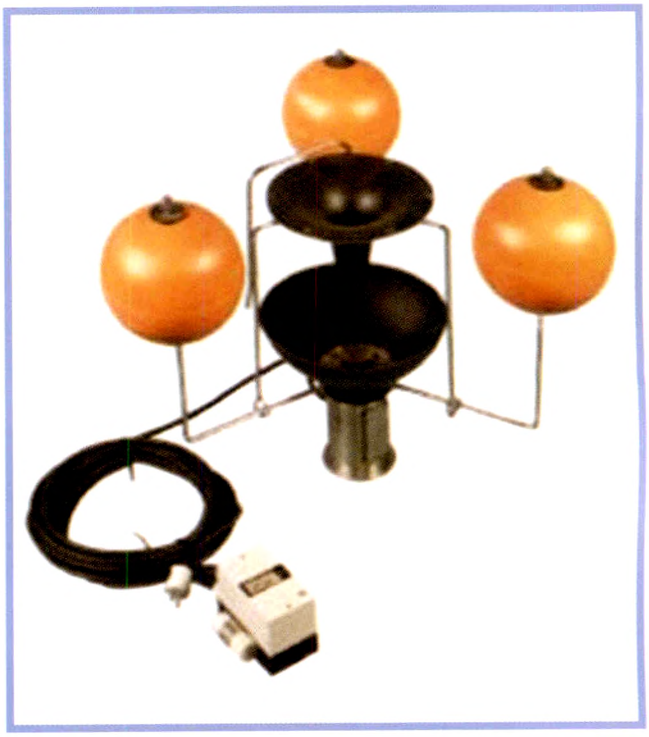


http://www.dfid.stir.ac.uk/afgrp

LBSB Bio Reco Sdn. Bhd.

We are the regional distributor of BIO RECO Series, a machine which develops efficient oxygenation equipment for the rejuvenation of lakes, fjords and watercourses. The oxygenation equipment, which is based on the theory of nature movement, is patented, efficient, and has a very low energy consumption.

Our equipment gives the water a natural spiral movement and uses only very little energy once movement has been initiated. The spiral sucks atmospheric air down into the water, and the shape and speed of the propeller ensure that this air is transformed into millions of tiny bubbles. The propeller also disperses the air/oxygen out over a very big areawhile ensuring that it remains in the water for a long time. A number of Danish and foreign companies now use Bio Reco for the rejuvenation of lakes with a high level of success.



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Fax : 604 - 398 6000
www.lbsb.com

BIO-RAD

Bio - Rad Laboratories(s) Pte. Ltd.

BioRad is the company at the for - front of molecular biology research. An impressive range of products includes proteomics and genomic technology will be on display. In particular, their exhibition theme will include the potential of molecular tools for applications in fisheries and aquaculture research.

Bio - Rad Laboratory(s) PTE. LTD.
CT - 13 - 02, Subang Square,
Corporate Tower,
Jalan SS15 / 4G,
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Selangor Darul Ehsan

YSI Environmental

Arachem (M) Sdn Bhd

success lies in its commitment in consistently delivering quality products and services. Since our inception in 1990, we have evolved into a progressive company – renowned and highly respected as the country's leading provider of the world's most advanced scientific and engineering systems and equipment. We are also highly sought by the private sectors and government agencies for our up-to-date product knowledge and technical expertise. As the main marketer and service provider of cutting edge scientific and engineering product lines, Arachem continues to attract a diverse portfolio of clients involved in various industries, notably water and wastewater treatment, food and beverage, agriculture, aquaculture/ fishery, animal health diagnostic, chemical manufacturing as well as pharmaceutical.

Arachem stresses very much in providing excellent service to the customers and relentlessly pursue her commitment to the customers in line with their expectation on quality, cost and performance. Training and development of our personnel is very much a part of our company's culture. Our selected team of qualified chemists and service engineers are required to undergo regular international service courses to acquaint themselves with the latest technology and development of their respective field of expertise. This is pertinent to ensure that they are well equipped to provide clients with up-to-date technical support and consultation on all aspects.

Arachem has three main divisions viz Environmental Division, Engineering Divisionand Bio-Technology Division. Representing YSI renowned aquaculture products and systems is our Environmental Division. YSI products and systems are used throughout the world to measure, monitor, and provide high quality, reliable data to help you make critical decisions to improve the quality of water.

The parameters in water you might be interested in, whether single parameter or in multi-parameter combination, could include: Conductivity, Dissolved Oxygen, Turbidity, pH & ORP, Temperature, Salinity, TDS & etc.

Product Highlight:

YSI 5200 RECIRCULATING SYSTEM MONITOR

Designed specifically for Aquaculture Recirculating Systems, the new YSI 5200 Recirculating System Monitor and AquaManager™ Software integrate process control, alarming, and data management into one product. Simple enough to monitor one tank, powerful enough to manage a full scale farming operation from anywhere in the world.

- Multiparameter: DO, Temperature, Conductivity, pH, ORP, Salinity
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- Multi instrument networking capability via RS 485 port
- Plug-and-play...easy to install and maintain
- Flexible dosing and control software
- Four 10-amp control relays
- Inputs for level and/or pressure switches
- Remote alarm paging

Arachem (M) Sdn. Bhd.
(127181 D)

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Tel: 603-6276 2323 Fax: 603-6273 3555
E-mail: marketing@arachem.com.my
www.arachem.com.my
Contatc Person: Ms. Amy Yew

AWT Fusion Marine Sdn. Bhd.

- A joint venture with Fusion Marine Ltd, UK.
- Supply and construction of Polyethylene Fish Cages for Off Shore and Open Sea Tuna farming.

Types of Cages:

- AQUAFLEX – 3 Ring 250mm OD – 40m to 80m Circumference
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Qingdao, China

Langkawi

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Selangor, Malaysia
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Fax: +603 5569 1639
awtfusion@maxis.net.my

HUNZA Consolidation Berhad

Hunza was founded by the KHOR Family in Malaysia about 30 years ago in a fishing village at the North of Malaysia. Our home country – Malaysia, situated in South East Asia, is a tropical paradise surrounded by famous world resorts. Malaysians are living peacefully in the multi racial society with multi lingual, multi culture and freedom of religions. Malaysia has been led by the visionary leaders, who has transformed the basic economic of depending solely on the export of commodity products into a world leading manufacturing centre for electronic and electrical products and is moving towards knowledge-based economy. "Today, Malaysians enjoy a stable political climate, strong economic growth and healthy lifestyle in this peaceful country."

Hunza's success story grows in line with Malaysia's economic development. In early 1970s, the first business venture was an off-shore fishing and fish trading for domestic market, which later expanded to incorporate processing and exporting of seafood business. In the early 1990s, Hunza ventured into manufacturing of corrugated cartons and paper packaging business and supplies to the industries users in domestic market.

In mid 1990s, a new holdings company, HUNZA CONSOLIDATION BERHAD was incorporated as the vehicle to consolidate the seafood and packaging business under same business group. In 1997, the holdings company was converted into a public company and was successfully listed in the Bursa Malaysia.

Today, Hunza has expanded the manufacturing facilities and become a leading business group that serves its customers in the global market. Despite the rapid changes in both internal and external environment, Hunza continues to uphold its basic beliefs to focus on core businesses and deliver high quality products and services to the valued customers. Our future plan will be the focus to enhance our operational excellence and people's competency, and to offer better products and services at competitive price to our worldwide customers.

Hunza appreciates your continued patronage and we look forward to develop a long term partnership with you. Together, we will build a better future.

HUNZA Consolidation Berhad
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Tel: 605 - 716 8588
Fax: 605 - 717 4299
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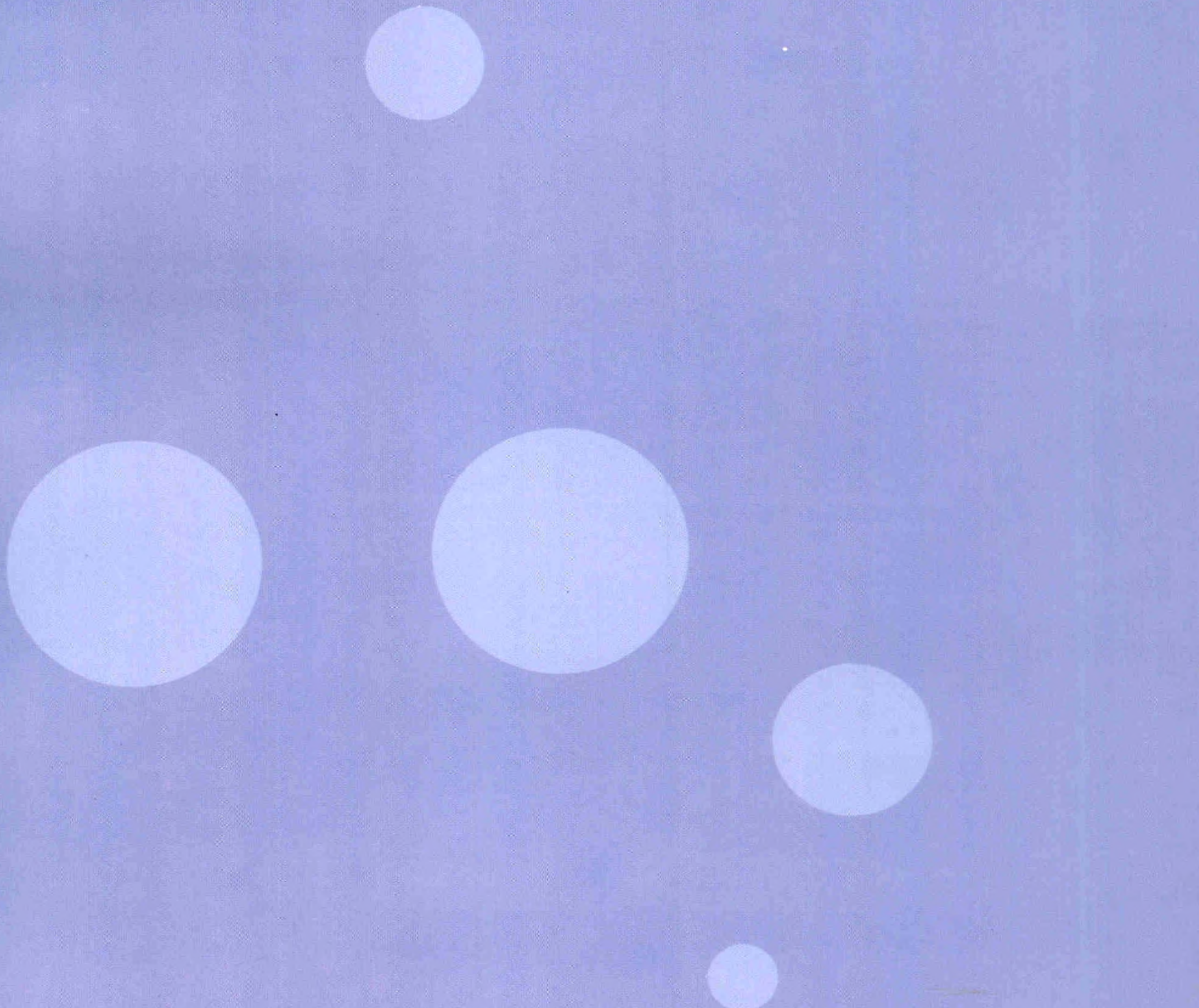

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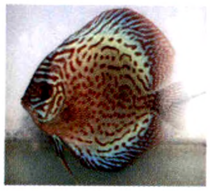

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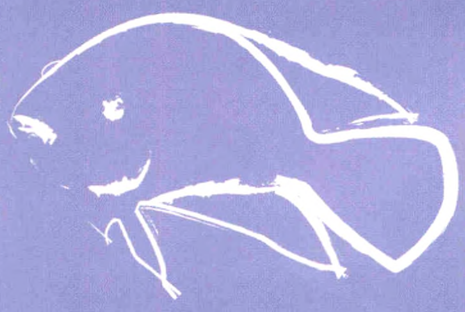

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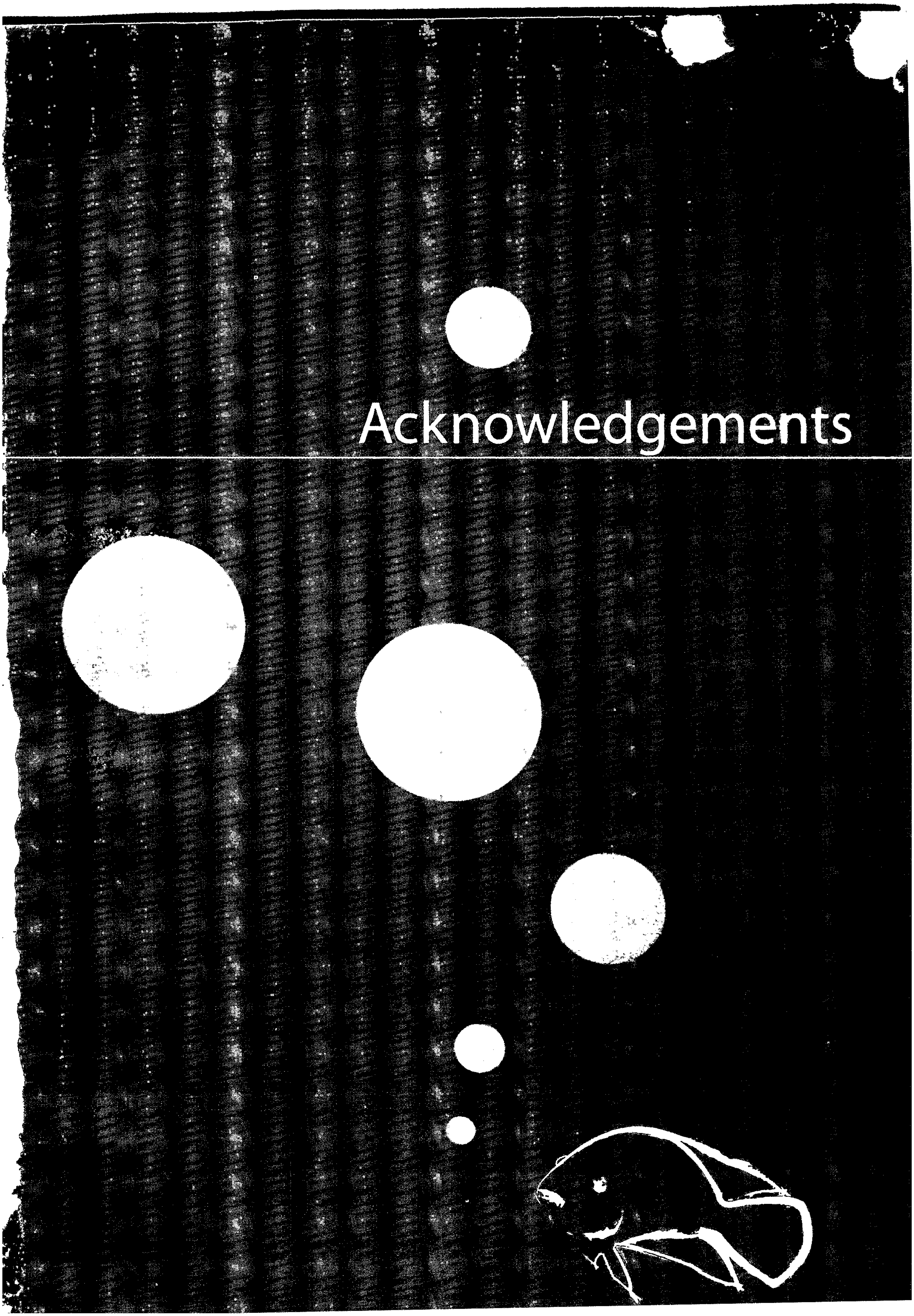

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